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A WEEKLY ILLUSTRATED JOURNAL OF SCIENCE.

"To the solid ground
Of Nature trusts the mind which builds for aye."—WORDSWORTH.

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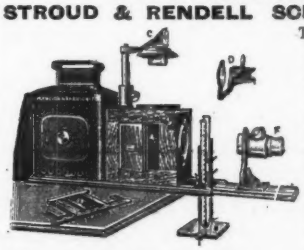

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January, 1919.

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THURSDAY, JANUARY 23, 1919.

DISEASES OF PLANTS.

Fungi and Disease in Plants: An Introduction to the Diseases of Field and Plantation Crops, especially those of India and the East. By E. J. Butler. Pp. vi+547. (Calcutta and Simla: Thacker, Spink, and Co., 1918.)

THE research work published from time to time by the staff of the Agricultural Research Institute at Pusa has shown a high standard, which is well maintained by this pioneer volume on the fungous diseases of field and plantation crops of India and the East, written by Mr. E. J. Butler, Imperial mycologist for India. When we realise what a dull book might have been compiled in the old "museum catalogue" manner, we gratefully extend a warm welcome to this volume, through which the spirit of research breathes so strongly.

The book is divided into two sections, and in each the numerous references made to the work of mycologists all the world over, and the excellent bibliography, are evidence of the wide reading of the author.

In part i. we have a clearly written introduction to the study of mycology, with chapters on the nature of fungi, their food, the life-histories of parasites, the causation of disease, and the principles of the control of plant diseases.

We have so few scientific data as to "conditions affecting the host" and "predisposition" that a satisfactory treatment of the subject is almost impossible. Mr. Butler states (p. 124) that "the mere growth of a plant under glass may reduce its resistance" to rust and mildew; just recently the converse has been proved to be the case with respect to the hop-plant and its mildew. Anyone who has studied the attacks of the oak-mildew in woods in England will find it impossible to believe the statement (p. 116) that "the injurious effect of factory smoke" is required to "lower the resistance" of this host-plant. Mr. Butler assumes that the new varieties of potatoes put on the market as "blight resisters" are all really so at the start, and that they "deteriorate" and become susceptible. It may be asked whether there was really scientific evidence of such original immunity, or whether it is not a common "trick of the trade" to describe new varieties as "blight resisters." We still remember the shock of finding *Septoria petroselini* and *Cercospora melonis* virulently infesting a new variety respectively of celery and cucumber, each described as "——'s Disease Resister"! That immunity does not "wear off," so to speak, appears to be proved with regard to certain varieties of potatoes which resist the attacks of "wart-disease" irrespective of the age of the variety or the vigour of the shoot. Again, in those cases where it appears that a parasitic fungus recently introduced into a country diminishes its virulence of attack, the possible explanation must not be lost sight of that —as with the chrysanthemum when its rust found its way into this country—the most susceptible varieties go out of cultivation and are replaced by more resistant ones.

Part ii. comprises "Special Diseases." Nearly 200 diseases of Indian crops are mentioned; each disease is given, first, a general description, admirably written for the needs of the "man on the land." The description of each growing crop and its particular disease has that invigorating freshness which the use of the field-notes of a keenly interested investigator alone can give. No planter could wish for better accounts of the "Tikka" disease of the ground-nut, of the seedling blight" of castor, and of the "red rot" and "wilt" of the sugar-cane; the author's strong, clear, descriptive style is also well shown in his treatment of the diseases of tea and rubber. After the general description of the disease, technical details are given sufficient to satisfy the needs of the student. The very numerous illustrations, many of which are from drawings of native Indian artists, or copies by them in ink or wash of Mr. Butler's fine pencil work, are exceptionally good: the sensitive drawings of leaves—*e.g.* in Figs. 124 and 127—are a delight artistically.

Many columns here could be filled with extracts from this book of great interest both from the economic and the purely scientific sides. We are enabled to realise the special difficulties of combating fungous diseases in such countries as India; to see "the spraying coolies who have to climb the trees"; to watch the distribution through the villages of Bombay of "one-anna packets of copper sulphate" (sufficient to protect against "smut" enough seed of "jowar" to sow four acres); and to admire the industry of those tea-planters who, over an area of 1300 acres, hand-picked and destroyed in two seasons more than 32 tons of leaves affected with "blister blight" (Exobasidium). The money losses involved in many of the diseases is very considerable; the value of the grain of "jowar" destroyed by "smut" in Bombay alone is estimated to exceed a million sterling annually. Among a mass of interesting facts we may note the correlation of epidemics of wheat rust with the varying humidity of the air; the killing of the mycelium of *Phytophthora infestans* in the potato-tuber by the climatic heat of the plains; the marked parasitism of Cladosporium (which appears to be becoming a pest in England) on wheat and "jowar"; and the existence of specialised "flax" and "linseed" races of *Melampsora lini*. It may be pointed out that the general statement (p. 62) that "in black rust the æcidial form on the barberry has the same specialisation as the uredo-teleuto," while true as regards some countries, needs to be qualified by reference to the work of Arthur in 1910, which showed that in the United States the specialisation of parasitism has proceeded on different lines; the genus Oospora (p. 81) is now replaced by Actinomyces; the word "botanical" is used wrongly (pp. 60, 61) to mean "morpho-

logical"; the wall of the perithecium in the Erysiphaceæ does not gradually rot away (p. 273), but opens by a definite rupture; and it is very heterodox to state (p. 143) that the right way to mix the components of Burgundy mixture is exactly the same as with Bordeaux mixture.

High praise must be given to the printers for surmounting so successfully the special difficulties of printing which obtain at Calcutta; the misprints are so rare that the two noticed may be mentioned here—at p. 163 "rust-resting" is printed for "rust-resisting," and at p. 353 "sacospores" for "ascospores."

This work, which is particularly delightful in its readable quality, will inevitably become the "classical" book of reference for both the cultivator and the student of mycology in India. It would be well if in the next edition the author gave more information on "pure culture" methods, enriched as this would be by his intimate knowledge of how to overcome the difficulties that result from the special climatic conditions.

E. S. S.

THE DOUBLE-STAR WORKER'S VADE-MECUM.

The Binary Stars. By Prof. R. G. Aitken. Pp. xiv+316. (New York: Douglas C. McMurtrie, 1918.)

THIS book is issued as one of the series of semi-centennial Publications of the University of California. We are informed in the introduction that "the object of this volume is to give a general account of our present knowledge of the binary stars, including such an exposition of the best observing methods and of approved methods of orbit computation as may make it a useful guide to those undertaking the investigation of these systems; and to present some conclusions based upon the author's own researches during the past twenty years."

The spectroscopic binaries, and also the visual binaries, are regarded as "members of a single species," and the development in recent years of both sections has tended to show that "the only differences between the spectroscopic and visual binary stars are those which depend upon the degree of separation of the two components." Granting this, the compilation of such a volume as that now under review became inevitable; and no one man is more favourably equipped for the task than Prof. Aitken, who, while living in the midst of workers in the spectroscopic section, is himself the incarnation of the visual section. Although not mentioned here, eclipsing binary stars are also regarded as members of the family, and the exhaustive and interesting chap. vii., which the author devotes to them, certainly adds value to the book. There are at present about one hundred and fifty known, and the chapter is based on the researches of Russell and Shapley.

The substance of chaps. i. and ii. is historical, and the author proves that, in both visual and spectroscopic work, American observatories have made double-star astronomy peculiarly their own. It is indeed the fact, and explains why American astronomers are so prominent throughout the book.

Chap. iii. is devoted to observational methods and means, including the micrometer, resolving power, and personal equation. As one would expect, there is much sound and practical advice. On the working catalogue, a difficult subject, it is Prof. Aitken's deliberate judgment that, under average good observing conditions, the angular separation of pairs measured should be nearly double the theoretical limit. Of course, observers with the largest telescopes must not be bound by this, for if they do not measure the very closest pairs the time devoted to their discovery is wasted. The note on the non-use of diaphragms is short and sound. The reviewer found a neutral-tint glass at the eye-end a sufficient and more convenient help.

In chaps. iv. and vi. the author discusses fully the various methods in use for computing orbits of visual and of spectroscopic binaries respectively. He carefully points out the advantages of each method, giving many useful hints, and illustrations by concrete examples. These two chapters have been well considered and developed; they practically exhaust the subject.

Between these two chapters is another in which will be found a welcome description of the spectroscope and of the manner in which accurate measures of displacement in the spectral lines can be made, the photographic portion being illustrated by a minute account of the "Mills spectrograph." In chap. viii. is a table of eighty-seven visual binaries "divided into two groups, the first containing orbits which are at least fairly good approximations, the second the less accurate orbits." But as we are told that "several orbits included in either one of the two groups might find a place in the other," the division seems superfluous. These orbits have been selected in general because they are the most recently computed. There is also a table of 137 spectroscopic orbits, but only 119 are used in the discussions. From a number of interesting results we extract the following relations between the periods and eccentricities:—

46	spec.	bin.,	mean	period	2·75	days,	ecc. 0·047
19	,,	,,	,,	,,	7·80	,,	,, 0·147
25	,,	,,	,,	,,	23·00	,,	,, 0·324
29	,,	,,	,,	,,	1·5	years	,, 0·350
30	vis.	bin.,	,,	,,	31·3	,,	,, 0·423
20	,,	,,	,,	,,	74·4	,,	,, 0·514
18	,,	,,	,,	,,	170·0	,,	0·539

A relationship so definite must have a physical significance. Later, on p. 221, it is shown that in the Cepheid variables this relation does not hold.

Treating of relative masses of visual binaries, Prof. Aitken remarks: "The most reliable values are those deduced by the late Lewis Boss," and the table on p. 216 is constructed on this idea, the work of several other computers being omitted. This is a pity, and the author himself is not convinced, for later he tells us that Boss

obtained a value of 1·8 for 85 Pegasi, but *adopted* 1·0; and on p. 233 he also points out that in Sirius we have a system in which is an even greater disparity between mass and luminosity in the two components, and he adopts Boss's computed value. Incidentally, this weakens one of the facts of observation made use of in discussing the "origin of the binary stars." Future progress is dependent on departures from our preconceived ideas.

In chaps. x. and xi. the author is more happy in dealing with his material—a large percentage being his own contribution during the last twenty years—and we are given a number of most interesting tables and results. Here are a few:—(1) At least one in every eighteen stars, on the average, in the northern half of the sky, which are as bright as 9·0 B.D. magnitude, is a close double star visible with the 36-in. refractor. (2) The percentages of double stars by magnitude classes are:

Mag. to 6·5	percentage 11·1	7·6 to 8·0	percentage 6·8
6·6 „ 7·0	„ 7·9	8·1 „ 8·5	„ 5·3
7·1 „ 7·5	„ 7·2	8·6 „ 9·0	„ 4·1

(3) Visual doubles are relatively more numerous in the Milky Way than elsewhere in the sky. (4) Visual binaries as bright as 6·5 magnitude are in excess amongst class G stars, and least in K and M. (5) Visual and spectroscopic binaries of every spectral class increase in numbers as the Milky Way is approached. (6) Spectroscopic binaries as bright as 5·5 magnitude are far the most numerous amongst stars of spectral type B.

To these are added, in chap. xi. the following from points brought out in the previous chapters: (7) The considerable percentage of multiple systems. (8) Close correlation between period and ellipticity. (9) Period and spectral type. (10) Relative brightness and relative masses of the two components. (11) Relatively great mass of a binary compared with the sun. (12) Spectroscopic binaries of class B, on the average, are three times as massive as those of later types.

All these and other minor points are discussed in connection with their bearing on the "origin of the binary stars." Of the three theories: (1) Capture, (2) fission, (3) independent nuclei, the author, having no alternative theory of his own, favours (2). The book contains a mass of interesting data well discussed. The physicist as well as the astronomer will find it a real treasury. It must also appeal to the wider circle of our readers.

THE SCIENCE OF IRON-FOUNDING.

Cast Iron in the Light of Recent Research. By Dr. W. H. Hatfield. Second edition, revised and enlarged. Pp. xvii + 292. (London: Charles Griffin and Co., Ltd., 1918.) Price 12*s.* 6*d.* net.

THIS important work on the metallurgy of iron and steel has been enriched, in its second edition, to the extent of some forty-six pages of new matter, including thirty-nine fine reproductions of micro-structures. The chapter on "The Heat Treatment of Cast Iron" has been divided so that the annealing of grey cast iron is treated separately. The new matter includes Prof. Carpenter's valuable contribution on "The Effect of Working Temperatures on Parts of Internal-combustion Engines," the author's report to the Ministry of Munitions on "The Present Position of the Malleable Casting Industry in this Country"—an illogical but welcome inclusion—"The Influence of Sulphur in the Presence of Silicon" (chap. xv.), and "The Limits of Phosphorus in Malleable Castings" (chap. xvi.).

A careful perusal of this work suggests that not much research, recent or ancient, has escaped notice, and everything worthy of note on the theoretical or the quasi-practical side of cast iron is included within the covers of the book. The difficulty is to locate and isolate in a concise form any particular information required. The impression is created that the author has been more or less overwhelmed by the mass of data collected. This results in a sense of uncertainty and a tendency to confusion in the mind of the reader. The author, who is undoubtedly an expert in his subject, would be well advised in any future edition to set out clearly a summary of each chapter, even more fully than has been done in the two new chapters, which in this respect are fairly well equipped.

The portions dealing with heat treatment, especially that which treats of malleable cast iron, bear the true impress of authority, and when this idea is conveyed by the rest of the book it should become the standard work on the metallurgy of cast iron as distinct from iron-founding. All such works should bear the hall-mark of a convincing personality.

The technically trained practical man will find great help in fitting himself either to meet specifications or to account for failures. Graduates and others seeking promising fields of research will find them in plenty, whilst those who delight in public controversy, provided they have easy access to a scientific library (so that the all-too-numerous references may be turned up), will be in clover. In the hope that this book may become the standard classic, we suggest that careful attention should be paid to what may appear to be matters of detail. For example, several graphs do not show clearly the increments which constitute the co-ordinates, and analyses occasionally are far from complete.

It is to be regretted that the chapter on mechanical properties is included in its present form. This should be entirely re-written. Even the pressure of war-time duties does not excuse the use of such terms as "breaking strain in tons per square inch" and "compressive strain." Admitting that cast iron is almost devoid of ductility, "breaking load" is not the correct expression. Again, in dealing with the transverse test, too little attention is paid to the relative value of the maximum stress under the two recognised standard conditions, and there is no

reference to any correction for slight variations in sectional area, whilst undue prominence is given to the maximum load on section calculated to tons per square inch, which form of report is of very doubtful use.

Dr. Hatfield is to be heartily congratulated on this work as a whole.

OUR BOOKSHELF.

A Modern Pilgrim in Mecca. By Major A. J. B. Wavell. New cheaper impression. With an introduction by Major Leonard Darwin. Pp. xv+232. (London: Constable and Co., Ltd., 1918.) Price 2*s.* 6*d.* net.

FEW Christians have been to Mecca, and fewer still to Medina, or, if they have attempted the journey, have survived to tell the tale. Here is the story of how a young man of twenty-six successfully accomplished the feat. Major Wavell, travelling in disguise *via* Beyrout and Damascus, reached Medina by the Hedjaz railway in 1908. After some weeks' stay in that city, where he had one or two narrow escapes from detection, he made his way by camel caravan to Yemba, on the coast, the overland route to Mecca being closed, owing to the rising of the Bedou tribes. From Yemba Major Wavell went by sea to Jiddah, and thence reached Mecca. His stay in Mecca seems to have been safer than in Medina, but not without risks. The pilgrimage to Mina was made before the return to Jiddah and the departure for Egypt. The book is full of information; many pages glow with colour, and not one lacks fascination. As the author says of himself, he was "never averse to being where anything interesting is taking place." That is the spirit in which he carried out this dangerous enterprise. His two companions were an Arab from Aleppo and a Mombasa Swahili. To avoid the chance of detection, he adopted the expedient of telling Arabs that his language was Swahili, and when he met natives of East Africa, of saying he was from Muscat and spoke only Arabic.

The book has an introduction on the geography of Arabia, with an account of Mohammedanism. Major Leonard Darwin contributes a short life of this daring soldier, whose brilliant career ended at the age of thirty-four, when he fell in action in East Africa at the head of the Arab corps which he had raised. The present edition is a cheap reprint; it has a map, but no illustrations. It is to be hoped that in the rising tide of war-books this fascinating volume will not be overlooked.

A Junior Course of Practical Zoology. By the late Prof. A. Milnes Marshall and the late Dr. C. Herbert Hurst. Eighth edition, revised by Prof. F. W. Gamble. Pp. xxxvi+515. (London: John Murray, 1918.) Price 12*s.* net.

IN the new edition of this well-known and excellent manual amœbæ from the soil are recommended for study as a substitute for the larger species *Amoeba proteus*, when this is not available, and two types not hitherto included—the large trypanosome of the dogfish and a tapeworm—are described. Careful directions are given for preparing a culture of the soil amœbæ and for obtaining trypanosomes by centrifuging the blood of the dogfish, the trypanosomes present being carried down with the blood corpuscles to the bottom of the tube, whence they can be withdrawn with a pipette for examination in a drop of the plasma.

In the account of the encystation of Amœba reference is made to the reproductive cysts from which issue "in one marine species at least . . . minute flagellated spores which conjugate in pairs and form amœbulæ." This statement relates, however, to a species of Paramœba, and as the account is headed "*Amoeba proteus*" it would have been better to refer to Miss Carter's observations on the reproductive cyst of this species from which amœbulæ were found to issue.

The kinetonuclear end of the trypanosome is regarded as anterior—a view which is not usually held. Although trypanosomes often move with this end in front when among a mass of corpuscles, the flagellum is usually anterior when free movement is possible.

There is a slip on p. 16, where it is stated that the zygote of Monocystis "divides four times, producing eight sporozoites"—there are, of course, only three successive divisions—and the statement on p. 33 that some of the buds of Obelia "have no mouth and become medusæ" is loose.

In the section of the work on vertebrates the principal change is the insertion in the text describing the rabbit's skull of a figure of the dorsal, and another of the ventral, aspect of the dog's skull.

How to Deal with Different Kinds of Fires. Some Hints by Sidney G. Gamble. Pp. 50. (London: The British Fire Prevention Committee, 1918.) Price 3*s.* 6*d.*

THE type of man generally placed in charge of works and property cannot be expected to have either the necessary experience or knowledge to enable him to direct advantageously or deal efficiently with an outbreak of fire, especially if the materials are not the ordinary combustibles, but chemicals, forage, coal, and the like. To assist these men and others the British Fire Prevention Committee has issued this Red Book, which is No. 201 of the committee's publications. Mr. Gamble, who until 1918 was second officer of the London Fire Brigade, gives in the first part of the book general information, and the effect of water, steam, chemicals, and so on, applied from different forms of fire appliances. The second part of the book deals alphabetically with numerous materials and kinds of fire in turn. Useful scientific data have been added, while an appendix on spontaneous combustion and a list of enactments bearing on the fire question complete a very useful compilation.

LETTERS TO THE EDITOR.

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. *No notice is taken of anonymous communications.]*

Wireless Telegraphy and Solar Eclipses.

JUST before the beginning of the war in 1914 the Radiotelegraphic Committee of the British Association, which was appointed at the Dundee meeting in consequence of a suggestion by me, had completed arrangements for certain observations to be made on the strength of radiotelegraphic signals on the line of totality of the 1914 solar eclipse which passed through Russia. These arrangements were rendered useless by the outbreak of the war. On May 29 of this year a total solar eclipse will be visible in North Brazil, and it seems very desirable that any eclipse expeditions sent out to observe it should be provided with wireless telegraph apparatus, and should arrange to receive, and also to send, signals to other stations before, during, and after the passage of the moon's shadow.

It is very important to ascertain, if possible, whether there are any effects on signal strength due to the passage of the moon's shadow over a station such as accompany the diurnal passage of the earth's shadow at sunrise and sunset. Evidence obtained from long-distance wireless transmission points conclusively to the close connection between it and the ionisation of the upper regions of the atmosphere. There is time now to make arrangements for the erection of temporary wireless stations on the line of totality of the eclipse, and to arrange a programme of operations. May I suggest to those organising eclipse expeditions the desirability of doing this? J. A. FLEMING.

University College, London, January 14.

The Neglect of Biological Subjects in Education.

THE resolution of the Headmasters' Conference and Headmasters' Association, referred to in NATURE of January 9 (p. 379), that school instruction in natural science should include biology as well as chemistry and physics, reminds me of an impression which has been with me for some time that a similar reform is needed in our higher education. Arising, I suppose, from the curious notion that chemistry and physics are more exact and educative and of more general moment in the lives of animals than are botany and zoology, it is laid down at Oxford, for example, that a student who proposes to take a biological subject for his final school must pass an elementary examination in chemistry and physics, while if he specialises in chemistry or physics he is exempt from any preliminary course in biology. Something similar is, I believe, a pretty general regulation in all the universities in this country—and if not a regulation, at any rate a habit. The result is that a number of chemists are produced who are fearfully ignorant of the simplest truths of biology; they do not even know what biology is about or the general methods whereby a biologist will seek to solve his problems.

It is probably too much to ask that the education of those who devote themselves to the pursuit of natural knowledge should be such as would generate in them that sympathy with arts studies which we need so much, but we can at least try to secure that the various departments of natural science should be more sympathetic with one another's aims. Sympathy comes from understanding, and I think a considerable step in the right direction would be made by having compulsory instruction in botany and zoology as well as in chemistry and physics for *all* students in our schools of natural science. The reform is quite simple and would present no practical difficulties, which is more than can be said for some projects of reconstruction. A. E. BOYCOTT.

17 Loom Lane, Radlett, January 13.

The Aurora Borealis of December 25, 1918.

THE aurora borealis of December 25, 1918, was manifested here from 5h. 45m. to 11h., and among the more interesting features presented may be mentioned the great arch of light, with its apex at roughly N.N.W., having a dark transparent interior with the

FIG. 1.—The aurora borealis as seen at Bramley, Yorkshire, on the night of December 25, 1918.

stars shining therein. The light nebulous clouds outside the arch, alternating rapidly in intensity, as well as the radial pulsating streamers, were especially noteworthy.

The accompanying illustration gives an approximate idea of the phenomenon as seen here. Vega is shown within the arch. SCRIVEN BOLTON.

Waterloo Lodge, Bramley, Leeds,
January 10.

PATENT LAW AMENDMENT.

A BILL to amend the Patents and Designs Act, 1907, was presented to the House of Commons by Sir Albert Stanley, President of the Board of Trade, as a Government measure in the latter part of 1917. This Bill was ordered to be printed on November 19, 1917. Considerable modifications in the 1907 Act are proposed in clauses 1, 2, 11, 14, and 17 of the Bill. These clauses provide new sections to replace sections 24, 27, 58, and 84 of the Act, the marginal notes whereof are respectively "Compulsory licences and revocation," "Revocation of patents worked outside the United Kingdom," "Cancellation of registration of designs used wholly or mainly abroad," and "Register of patent agents," and for the addition of a new section (38A) under Part I. of the Act.

The new section 24 makes provision, under safeguards, for patents, at any time after sealing, to be endorsed, at the request of the patentee, with the words "licences of right." After a patent has been so endorsed, all persons become entitled as of right to the grant of a licence to work the invention covered by the patent. Provisions are included in this section for the fixing of the terms of the licence, in default of express agreement between the patentee and the licensee; for the prevention of the importation into the United Kingdom by the licensee, in certain cases, of goods that would be an infringement of the patent; and for dealing with cases of infringement by unlicensed persons.

The new section 27 makes provision for ensuring that patented inventions shall be worked on a commercial scale within the United Kingdom, and empowers the Comptroller, in a proper case, either to endorse a patent with the words "licences of right," regardless of the wishes of the patentee, so as to bring it within the operation of the new section 24; or to grant a licence on such terms as he may deem expedient, or even to revoke a patent.

The new section 38A provides that articles intended for food or for medicinal or surgical purposes, or capable of being used for the production of food or medicine or of surgical appliances, shall not be patentable, although the processes for making foods, drugs, and medicines remain patentable as heretofore.

The proposed new sections 58 and 84 call for no special remarks here.

Among the other modifications introduced by the Bill there are, *inter alia*, new provisions (*a*) for the settlement of differences and disputes in relation to the grant and sealing of patents (cl. 5); (*b*) for increasing the original term of the patent from fourteen to fifteen years (cl. 6); (*c*) for amending section 18 of the principal Act so as to allow of an extension of the term of a patent on grounds attributable to circumstances connected with war (cl. 7); (*d*) for the grant of relief in infringement actions where the court finds any one or more claims are valid (cl. 8); (*e*) for depriving a plaintiff in an infringement action of relief by way of an account of profits (cl. 9); (*f*) for the exclusion of evidence in the courts in relation to an assignment of a patent unless the same has been recorded on the register of patents (cl. 15).

The 1917 Bill was introduced in the House of Commons in the spring of last year by the President of the Board of Trade, but was not proceeded with.

In February of last year the Institution of Electrical Engineers appointed a committee (*a*) to consider the provisions of the 1917 Bill, and (*b*) to report on the question of Patent Law Amendment generally. The report of this committee, which was composed of well-known members of the legal and engineering professions, and sat under the chairmanship of Mr. W. M. Mordey, has, with slight modifications, been recently published by the Institution of Mechanical Engineers. In an introductory note thereto it is explained that many of the technical and scientific societies, either representative of, or closely connected with, the great industries of the country, set up committees to examine the 1917 Bill; later, on the invitation of the president of the Institution of Mechanical Engineers, a conference, attended by representatives of twenty-six institutions and societies, was summoned, and held several meetings for the purpose of securing, if possible, united action in relation to the Bill in question. The Institution of Electrical Engineers placed the report of its committee at the disposal of this conference, the members of which, having approved the principles contained therein, adopted it as the basis of a memorandum on Patent Law Amendment and arranged, in connection therewith, for a deputation to wait on the Board of Trade. The deputation was received, on October 10, 1918, by the Rt. Hon. G. J. Wardle, M.P., then Parliamentary Secretary to the Board, in the unavoidable absence of the President, Sir Albert Stanley.

The Parliament in which the 1917 Bill was introduced having been dissolved, it is extremely improbable that this Bill will ever be revived in its present form; however, the criticisms on this Bill and the suggestions contained in the report of the committee referred to above continue to be of importance, in view of the legislation in relation to the amendment of the Patent Law which may be proposed in the future.

The committee, in an introductory statement in the report, sets out the main principles and considerations by which it has been guided in carrying out its task. It points out that, in the interests of industrial enterprise, a twofold duty rests on the State in relation to invention, viz.: (*a*) to provide encouragement to the inventor, and (*b*) to provide also an incentive to capitalists to assist in the commercial development of inventions. It expresses the opinion that during the past quarter of a century the effect of legislation in this country has been to act as a deterrent rather than as a stimulant to invention, and urges that "every effort should be made to reduce, if not remove, the number of weapons available to people here and abroad, especially the latter, for attacking patentees who own real inventions."

The committee points out that the amendments proposed to section 18 of the Act (extension of term of patent) in clause 7 of the Bill to meet war conditions have the effect of leaving matters practically *in statu quo*; the new provisions will continue to limit extensions of the term to inventions of special merit. It is of opinion that "the Bill perpetuates the evils of the present procedure, which are such that the number of petitions for extension presented annually is under ten." The committee feels that the situation created by war would best be met by a separate Patents Moratorium Act, wherein provision should be made for the automatic prolongation of patents for a period equal to the duration of the war.

The committee does not view with favour the new sections proposed in substitution for sections

24 and 27 of the Act. It would prefer to see section 27 ("Revocation of patents worked outside the United Kingdom") repealed, and section 24 ("Compulsory licences and revocation") altered by enacting that (i) petitions for grants of "compulsory licences" should be made to the Comptroller of Patents with a right of appeal to the courts, and (ii) provisions enabling patents to be revoked should be cancelled. It holds the view that it is "wrong and illogical that letters patent should be revocable on the ground of non-working, except with the consent of the owner. The only justification for revoking a patent is that it is invalid."

The committee also expresses the opinion that "the possibility of revocation on the ground of non-working is an incentive to blackmailers, and greatly detracts from the value of a patent for financial support." It believes that the alternative proposed by it would best meet the interests of invention and industry.

The committee disapproves of the provisions of the new section 38A, which prevent articles intended for food or for medicinal or surgical purposes, etc., being patentable. It is pointed out that the effect of the new section would be to deter inventors and capitalists from devoting their time and money to the development of industries which are admittedly in great need of stimulation —industries, too, in which this country is notoriously behindhand.

The committee in express terms approves of the provisions contained in clauses 5, 8, 9, and 15 of the Bill (see *ante*). Its views on some of the other matters dealt with in the report are as follows:—The term of the patent should be fixed at seventeen years; the period within which the complete specification must be filed should be extended; the procedure in relation to the grant and sealing of patents should be improved; disappointment is expressed that no substantial alteration is made in the Bill for binding the Crown, and the suggestion is made that, in cases of user by the Crown of an invention, the patentee, in default of an express agreement on the subject, should be entitled to apply to the High Court to adjudicate upon his claim and to determine the terms in respect of such user; the prescribed fees for a full-term patent should be reduced, in view of the large annual surpluses of the Patent Office budget.

Finally, the committee advocates that a new tribunal should be set up to deal with litigation involving scientific and technical questions; a similar proposal has been made by the Federation of British Industries. The committee acknowledges the great ability of the judges of the Chancery Division and their willingness to try scientific cases, but it points out that "the views of the judges as to what is invention has varied to a degree which has made it nearly, if not quite, impossible for manufacturers to obtain definite opinions as to the chances of success in patent disputes." It is urged that "if industry is to flourish to the fullest extent there must exist machinery for adjudicating effectively upon actions involving technical matters."

The question of the creation of a new tribunal to deal with patent actions and kindred cases has been before the Bar Council during the past year; the executive committee of the Council received a deputation from the Law Society on the subject in January, 1918, and afterwards appointed a special committee to consider the matter. This special committee has held several meetings and presented a report, which is now under the consideration of the Bar Council; it is understood that the members of this committee, who are all well-known King's Counsel, are in favour of the proposal to create a new tribunal for the trial of patent actions and of cases involving great technical or engineering details.

There is much in the report of Mr. Mordey's committee with which those whose interests particularly centre in Patent Law will heartily agree; to many of the recommendations of this committee effect can be given without difficulty or further elaboration. The same, however, is not the case as regards the proposal to establish a special tribunal to deal with actions involving technical matters. The proposal to create such a tribunal is worthy of all support; however, its constitution and the field of selection from which the judge to preside over it is to be obtained are questions which will require very careful consideration. It must be borne in mind that no single judge, however versatile, can possibly be expected to possess a sufficiently wide range of scientific and technical knowledge to enable him to cope successfully with the great variety of matters which would find their way into a court of the kind in contemplation. The proper solution would be to create a permanent statutory panel of technical assessors as an adjunct to the proposed new tribunal. Assessors suitably chosen from this panel, in accordance with the requirements of any particular case, should sit in the proposed court to assist the judge trying an action by elucidating the technical aspects of the case.

A belief widely prevails that patent protection is valueless in this country; it is the existence of such a belief which points to the urgent need for a reform of our Patent Law; and it is essential that it should be recognised that no reform of our Patent Law will be satisfactory which does not include a revision of the law of novelty and the practice of examination founded on that law. Under the Statute of Monopolies novelty was confined to "prior user" *within the Realm*, and the patentee was granted his privilege, not *qua* "inventor," but *qua* "institutor," or importer of a manufacture new as regards practice within the Realm. It is essential that the position of the "institutor" should be now reaffirmed, not only in the Act, but also in the grant and petition.

Further, it must be borne in mind that not only have the special interests of the inventor and of the "institutor" or capitalist to be adequately protected by legislation, but also those of the consumer and of the Crown, as the agent of the

public at large; the Patent Law requires to be so framed that each of these interests shall be provided with suitable safeguards. Therefore, whilst it is desirable that the ambit of a patent should be widened and its validity after introduction made less open to impeachment, there is no good reason for extending the present statutory term of a patent, which is founded on the old practice of apprenticeship; moreover, it must always be borne in mind that during the period of a strong monopoly all incentive to improvement is removed, a situation being created which is as much to the detriment of the inventor and of the capitalist as of the individual consumer, and of the State also.

NATURAL AND ARTIFICIAL CAMOUFLAGE.

IN an interesting essay on "Camouflage" (*Scientific Monthly*, December, 1918, pp. 481–94) Mr. Abbott H. Thayer illustrates his well-known conclusions in regard to the cryptic coloration of animals that hunt or are hunted. In their "superhuman perfection" the concealing coats of wild animals have become the models for the camouflage corps of armies. The patterns which animals exhibit "always inevitably tend to conceal," and that in direct ratio to their strength—*i.e.* the degree of difference among the component notes. "Monochrome, no matter how grey, *reveals* its wearer against all backgrounds whatsoever (and most of all if these are monochrome) except a background which is an absolute repetition of itself." What is practically universal is background-imitation, the deceptiveness of which is overwhelming. Mr. Thayer illustrates this by interesting views of brook-scenes and wood-scenes photographed through a stencil of bird or beast. The creature has the garment of invisibility because its "costume is pure scenery." "All the patterns and brilliant colours on the animal kingdom, instead of making their wearers conspicuous, are, on the contrary, *pure concealing coloration*, being the *actual colour notes of the scene in which the wearer lives*, so that he really *is* Nature's utmost *picture* of his background." Even the scarlet bodice of the scarlet tanager, by being a perfectly unbird-shaped scarlet patch amidst the forest foliage, is effective because it corresponds with the sprinkling of single scarlet leaves throughout the trees.

Two points must be borne in mind: (1) that the costume of a creature that does not change much throughout its life will correspond with "an average and expectable type of scene"; and (2) that what catches our eye may be quite elusive to the animal the sight of which was to be deceived, for a skunk that may seem to man conspicuous has been coloured "for concealment from the small creatures on which he feeds, and above which he looms against the sky."

It may be questioned, however, whether we know very much about the vision of the small creatures referred to. And when to the conclusion: "This resultant background-imitation is practically the universal accomplishment of animals' patterns," Mr. Thayer adds: "I have been left alone in the world to point this out," many readers will naturally wonder where Alfred Russel Wallace, for instance, comes in! This is a historical question, however, and the aim of Mr. Thayer's essay is largely practical—namely, the statement of a law of camouflage. "Man has only to cut out a stencil of the soldier, ship, cannon, or whatever figure he wishes to conceal, and look through this stencil from the viewpoint under consideration, to learn just what costume from that viewpoint would most tend to conceal this figure."

That this is not the whole doctrine of camouflage is suggested by the recent exhibition of "dazzled" ships or models of ships at Burlington House, where Lieut.-Commander Wilkinson's devices were admirably illustrated. The curious patterns or designs which have been painted on so many merchantmen and patrol-boats were thought out by Commander Wilkinson—like Mr. Thayer, an artist—not to make the ship inconspicuous, but to break up its form in such a way as to make it difficult for an attacking U-boat to estimate the course. A vessel at rest near the cliffs of a fjord or against the background of a wooded island can be camouflaged in various ways so as to become inconspicuous, but the "dazzled" ships expressed another idea, and elaborate trials have shown that even old, experienced seamen are so deceived by the strange designs that their estimate of the direction in which the ship's bows are actually pointing is usually wrong, and sometimes ludicrously wide of the mark. It is probable that some bird-designs—*e.g.* white tail-feathers—may have the same effect of breaking up the form of the body, thus making it more difficult for hawks to take a sure aim.

DR. H. E. J. DU BOIS.

DR. DU BOIS, whose death occurred at Utrecht on October 21, has left behind him a record of valuable work in magnetism, in optics, and in radiation. It was especially the connection between magnetic phenomena and the polarisation of light which led him into optical fields of research. Thus his earliest paper published in the *Annalen der Physik und Chemie* in 1887 deals with magnetic circular polarisation in cobalt and nickel. In 1889 Dr. Du Bois made his first appearance at the British Association, which met that year in Newcastle, and gave an account of his experiments on the Kerr effect in magneto-optics, showing how it could be used in the measurement of strong magnetic fields. The complete paper was published in 1890 in the *Ann. d. Phys. u. Chemie* and in the *Philosophical Magazine* (vol. xxix., p. 253). This paper was noteworthy both for the novelty of the method used and for the admirable manner in which the method was worked out. The fundamental idea was to measure the magnetisation at the surface of magnetised spheroids of iron, nickel, and cobalt by

its effect on polarised light reflected from small polished plane faces at various positions of the surface. The results obtained were at once a beautiful test of the theory of magnetic induction and an elucidation of the laws governing the Kerr phenomenon.

Another line of research which engaged Dr. Du Bois's attention, and on which he submitted a note before the British Association in 1892, was the action of thin wire gratings upon transmitted light and other forms of radiant energy. In association with Rubens he published two papers on this subject (*Ann. d. Phys. u. Chemie*, 1892, 1893). Dr. Du Bois also gave close study to the phenomena of magnetic screening, and communicated a series of instructive articles full of research to the *Electrician* (vols. xl. and xli., 1898). Much of his own work, as well as that of his contemporaries, will be found embodied in his book on "The Magnetic Circuit in Theory and Practice" (German edition, 1894; English edition by Dr. Atkinson, 1896). There is probably no other work in which the theoretical and practical aspects of magnetism are so ably welded together as in this important contribution to scientific literature. In Prof. Gray's review in NATURE of February 24, 1898, it is stated that the book "cannot be praised too highly as a piece of work sound from every point of view."

Dr. Du Bois did his earlier work in Strasburg University, but for many years he carried on investigations in his own private laboratory in Berlin. At the time of his death he had returned to his native land and was beginning his work at the new Bosscha laboratory at Utrecht. He was a frequent visitor at the British Association meetings in this country, and his tall, handsome figure and charming personality will long be remembered among his many friends. C. G. K.

NOTES.

WE understand that Sir Lazarus Fletcher will retire from the directorship of the Natural History Museum, under the age limit, on March 31. The office was made in 1856, under the style of Superintendent of the Natural History Departments, so that the Trustees of the British Museum might obtain the services of Sir Richard Owen, who supervised the planning of the new museum at South Kensington, and retired shortly after its completion in 1884. Under the style of director, Sir William Flower succeeded Sir Richard Owen, and he retired in 1898. For the next decade Sir E. Ray Lankester was director, and he was followed by Sir Lazarus Fletcher early in 1910. The task now falls on the Trustees of finding a worthy successor who shall maintain the high prestige of the museum among the corresponding institutions of the world. Public interest in the promotion of pure science has never been keener than at present, and naturalists will await with unusual eagerness the announcement of this new appointment.

FROM the *Times* of January 20 we learn that the Prime Minister is to receive a deputation which will put before him the case for a separate Ministry of Fisheries. We hope this deputation will get a more favourable reception than the one that waited on Mr. Prothero on November 27 last, and that it will not repeat the mistake made on that occasion, when it seemed to be taken for granted that the Minister had mastered the elaborate memorandum prepared by the National Sea Fisheries Protection Association, and that, in consequence, it was not necessary for the speakers to deal with the things that really mattered.

THE Conjoint Board of Scientific Societies has commenced the publication of a fortnightly Bulletin of Scientific and Technical Societies, giving a diary of forthcoming meetings, with titles of papers and discussions, together with a list of the constituent societies of the Board and their presidents. The Bulletin will prove a very convenient guide to scientific meetings being held day by day, and by issuing it the Conjoint Board is appropriately promoting the co-ordination of effort which is one of its main purposes.

CHEMISTS, especially those who have been engaged under the Ministry of Munitions, will be interested to learn that on the cessation of hostilities a letter of congratulation was addressed to Mr. K. B. Quinan, of the Munitions Explosives Department, by the president and secretary of the Institute of Chemistry, expressing on behalf of the fellows and associates their high appreciation of Mr. Quinan's services during the war. Apart from the fact that the great organisation developed for the production of explosives contributed very substantially to the success of the Allied arms, the institute recognises that through the technical training initiated by Mr. Quinan many chemists have gained experience which will prove of great benefit to them and to chemical industry when they come to devote their energies to the furtherance of the arts of peace.

DR. J. D. FALCONER, lecturer in geography in Glasgow University, who has been serving as a political officer in Nigeria since 1916, has been granted further leave of absence by the University Court, at the request of the Secretary of State for the Colonies, in order that he may act as the first director of the Geological Survey of Nigeria.

THE *Times* announces that Dr. F. G. Cottrell, chief metallurgist of the United States Bureau of Mines, who discovered a new process for extracting helium from natural gas, has been awarded the Perkin medal for distinguished services in applied chemistry by the American Chemical Society.

PROF. MARTY, whose death at the ripe age of eighty-four was recorded a short time ago, was a member of the Académie de Médecine, and to a past generation was well known in France as a pioneer of hygiene and food chemistry. Much of his work was carried out for the information of the military authorities in safeguarding the health of the French Army. For this purpose Prof. Marty made numerous analyses of the water supplied to military hospitals, and also of the beverages and foods used. He gave special attention to the subject of "plastered" wines and to the sophistication of wine with coal-tar colours and salicylic acid. One result of Prof. Marty's studies was the fixing of a limit (2 grams per litre) for the quantity of potassium sulphate to be permitted in French wine; since 1880 this limit has been generally adopted in other wine-producing countries. Working with a co-adjutor, he showed that hydrocyanic acid was present in tobacco smoke, and he also investigated the antiseptic action of air charged with phenol vapour as used in Lister's spray treatement. Many contributions from Prof. Marty's pen, dealing with the chemistry of coffee, chocolate, water, and spirituous beverages, appeared in the "Traité d'Hygiène" of Michel-Lévy.

THE Republic of Brazil has lost one of its most enlightened benefactors by the death of Dr. Rodrigues Alves, aged seventy years. Dr. Alves was born at San Paulo, and devoted his life to the public service. He appreciated fully the necessity of applying the discoveries of science to the welfare of a community living in the tropics, and when he was President of Brazil from 1902 until 1906 he so improved the sanitary condition of the ports that yellow fever was banished from them and they became comparatively healthy. Those especially who remember Rio de Janeiro at the end of last century, and also know its present condition, can realise the importance of Dr. Alves's reforms. To promote an adequate circulation of air, he caused a wide thoroughfare to be cut through the densest part of the old city. Swamps and waste ground, particularly on the margin of the bay, were transformed into dry promenades and fine gardens. Main drainage was attended to, and a sanitary service was established to undertake, among other duties, the pouring of oil on stagnant water. The intellectual life of the people was also fostered by the building of a national library and a national art gallery. Dr. Alves was elected for a second time as President last year, but failing health, unfortunately, compelled him to resign soon after this unique compliment had been paid to him by his grateful country.

WE regret to notice the announcement of the death on January 13, in his seventy-fifth year, of Dr. W. Marshall Watts, who was well known for his valuable contributions to the literature of spectroscopy. Dr. Watts was educated at Owens College, Manchester, where he studied under Sir Henry Roscoe, and he afterwards worked for some time in Bunsen's laboratory at Heidelberg. For thirty-three years he was science master at Giggleswick Grammar School, and after spending the early years of his retirement near London he removed to Southend, where he died. It was doubtless his association with Roscoe and Bunsen during the early development of spectrum analysis which led Dr. Watts to devote himself to the advancement of this subject. He made several original investigations, especially in connection with the spectra of compounds of carbon, but he will be best remembered for his "Index of Spectra," which first appeared modestly as a single volume, and has since been supplemented from time to time by a large number of appendices. The selection and arrangement of the data for these publications were made with excellent judgment, and the tables have greatly facilitated the work of investigators in this branch of science. Dr. Watts will also be gratefully remembered by many workers for the kindness with which he was always ready to place his special knowledge at their disposal. In recognition of his services to scientific investigation he was awarded a Civil List pension three years ago.

WE regret to notice the death of Prof. Gustave Bouchardat, which occurred recently in Paris. Prof. Bouchardat was formerly professor of hydrology and mineralogy in the Paris School of Pharmacy, and retired from this position some six years ago. His name has long been associated with the literature of synthetic rubber, a paper of his on this subject having appeared (in the *Comptes rendus*) so long ago as 1875. Camphor and borneol were some of the chief matters to which he had devoted attention, especially as regards the synthetic borneols and *iso*borneols. The action of acids on various terpenes was also a subject which he investigated. Prof. Bouchardat was born in 1842, and had been connected with the School of Pharmacy for about forty years.

BY the death, at the age of seventy-four, of Sir Gooroo Dass Banerjee, India has lost one of the most distinguished and universally respected Bengalis of our day. After a distinguished career at the Presidency College, Calcutta, Sir Gooroo Banerjee became a Vakil of the Calcutta High Court, and took an active share in the business of the city municipality. After holding a seat in the local legislature, he was raised to the High Court Bench, where he established his reputation as a sound lawyer. He was a member of the council of the Calcutta University, of which he acted as Vice-Chancellor, and he served on Lord Curzon's University Commission, to the report of which he contributed a characteristically independent note of dissent. He was a learned investigator of Hindu mathematics and Indian law and sociology—subjects dealt with in a long series of books. He combined plain living with high thinking to an exceptional degree. Sir Gooroo Banerjee has left four sons, all of whom hold high positions in the public life of Bengal.

THE death is announced of Mr. W. P. G. Graham at the age of fifty-seven. Mr. Graham entered the Royal Army Medical Corps in 1887, joined the Egyptian Army in 1890, served in the Tokar campaign of 1891, and in 1896 volunteered his services during the serious outbreak of cholera, after the cessation of which he accepted a post in the Egyptian Civil Service. In 1902 Mr. Graham was selected to reorganise the municipality of Alexandria, and for two years acted as administrator of that city. He then returned to Cairo, and was Director-General of Public Health in Egypt from 1907 to 1914, during which period he installed a water supply for Cairo and did much for the health of the country. Mr. Graham retired from the Egyptian Civil Service in 1914, and became an inspector of the Home Office under the Vivisection Act. In 1915 he took out Lady Wimborne's hospital to Serbia, with which he worked for some months. He was then sent by the War Office to Egypt, but an accident necessitated his return home after a short time, and he resumed his work under the Home Office.

THE cultivation of fungi by termites in their nests to serve as food for their young and for the queen is well known, and good accounts of the nests and their fungi have been given by Mr. T. Petch in the Annals of the Botanic Gardens, Peradeniya, in 1906 and 1913. A further paper on the fungi of termite-nests has now appeared in the Philippine *Journal of Science* (vol. xiii., sect. C, No. 4, 1918) by Mr. W. H. Brown. Mr. Brown's account is illustrated by two good plates showing the termite nests, the combs composed of small balls closely packed together and made apparently from the excrement of the termites, and the fungi growing on them. The fungi appear to be the same as those found in Ceylon and in the East generally, and are a conidial form, *Aegerita duthei*, which covers the combs thickly; a Xylaria, probably *Xylaria nigripes*, which grows out from the comb and forms a regular tomentum; and an Agaric, *Collybia albuminosa*. The wide distribution of these three fungi in termite nests is remarkable.

THE establishment of a French "Kew Gardens" is the text of a leading article in the *Gardeners' Chronicle* of January 4. The famous Jardin des Plantes at Paris has now become enclosed by the growth of the city, and a new site of 1500 acres is proposed in the park of Versailles between the Trianon and the Forest of Marly. The new garden would consist of about 100 acres, devoted to botanical collections, and would in the first place include those subjects which are

absent from the original garden in Paris. About 80 acres would be devoted to collections of fruit-trees and 250 acres to flowers and cultivation under glass. In addition, some 80 acres would be set apart for the installation of laboratories and for providing land for experimental purposes. The site suggested would appear to be an ideal one, as the soil is fertile, and the land belongs to the State and offers almost unlimited facilities for expansion. Moreover, there are already at the Trianon considerable collections of trees, dating from the time of Michaux. It might be added that the Trianon is sacred ground for the botanist, for there originated the natural system of classification of Bernard de Jussieu, which was developed by his nephew, Antoine Laurent de Jussieu, and afterwards further elaborated by Augustin Pyrame De Candolle. The system had its birth in the arrangement adopted by Bernard de Jussieu in the Royal Garden at the Trianon. The new project is being actively supported by the powerful French Touring Club.

PROF. H. H. DIXON (Scientific Proceedings of the Royal Dublin Society, vol. xv., p. 431) describes the microscopic characters of forty-five different kinds of timbers which have been classed under the name "mahogany." The name was originally applied to the timber derived from *Swietenia mahagoni* (Cuban, St. Domingo, and Spanish mahogany), a West Indian species, and from *S. macrophylla* (Honduras, Tabasco, and Colombian mahogany), a native of Central America, but it is doubtful if any of the timbers now on the market come from these sources, and certainly most of them do not. C. D. Mell has recently listed sixty-seven species of trees as supplying timbers the characteristics of which sufficiently coincide with the popular idea of mahogany to be marketed as that wood (U.S. Dept. of Agriculture, Bull. 474, February, 1917), and this list might be added to from our present knowledge. The mahoganies come from all parts of the tropics, and belong to very different families besides the Meliaceæ, to which Swietenia belongs. Prof. Dixon examines in detail the characters of these various timbers, and suggests a definition of mahogany to include all red or red-brown timbers in which the fibres of the adjacent layers cross each other obliquely, giving rise to a play of light and shade on longitudinal surfaces, known as "roe," thus greatly emphasising and enhancing the figure. In addition, a mahogany should have scattered wood-vessels, isolated or in small, mostly radial, groups; the parenchyma round the vessels should be narrow and inconspicuous, while the medullary rays are, on the average, well under 2 mm. in height, and not more than nine cells thick. In other respects the woods classed as mahoganies have very various properties; for instance, with regard to density, hardness, presence or absence of year-rings, pore-rings, size and contents of vessels, distribution of parenchyma, etc. Prof. Dixon gives a detailed description of the microscopic characters, and also 138 photomicrographic reproductions with a uniform magnification of 31 diameters.

THE columbines (Aquilegia) of North America form a very interesting group of some twenty-four species, which is described in detail, with good illustrations, in Contributions from the United States National Herbarium (vol. xx., part iv., 1918) by Mr. E. B. Payson. It is in the floral characters that the more interesting features are to be found, and the author draws a phylogenetic chart based on the length of the spurs and the character of the sepals and petals, which is instructive. The flowers in sixteen of the species are nodding with spurs less than 1·5 cm. long, while the remaining species have erect flowers with spurs ranging from 3·5 cm. long to those of *Aquilegia longissima*, which are from 10–15 cm. long. This species is probably the most highly developed in the genus, and is found in South Texas and Mexico. It is of interest to notice that when grown in eastern North America this species will not set seed unless artificially pollinated, which points to the length of spur being correlated with some insect in its native habitat which does not occur in other parts of North America. The author describes three new species and two new subspecies.

ALTHOUGH fungi, both fresh and dried, are largely used in Italian cookery, it would appear that much still remains to be done even in Italy in utilising them for food. The "Federazione Pro Montibus," of which the headquarters are at 113 Via del Seminario, Rome, publishes a pamphlet of twenty pages by Dr. Giulio Trinchieri containing practical instructions for collecting and preserving edible fungi. It is accompanied by illustrations of eight species. Of methods of preservation, drying is the most important, and might with advantage be practised more extensively over here even if only applied to the mushroom of commerce, which often goes to waste for lack of this simple expedient. The use of salt, vinegar, alum, and methods of sterilisation are also mentioned in the present pamphlet, which contains in addition a bibliography of some of the principal Italian books on the subject.

BRAZIL, among other countries, has suffered severely owing to the restriction of exports of coal and other fuel by Great Britain. On the other hand, this embargo has had the effect of directing attention to the vast fuel resources available in that State. Already working operations are in hand in some regions, and, according to the U.S. Commerce Reports, No. 276, various mining companies are being subsidised by the Brazilian Government to stimulate production, and the home-produced supply will be favoured by the authorities whenever possible in the future. Quite high-grade briquettes are being made from coal which has been "purified" by washing and crushing to reduce the ash-content. As regards fuel-oil, the Parahyba shale is reported to be richer than that of Scotland, the former producing 165 litres of crude oil per ton (16½ per cent. oil-content), while the latter produces 100 litres (10 per cent. oil-content). Portions of the shale suitable for distillation have already been found at a number of points. Various companies have been formed, and authorities have reported favourably on the fuel for motor-vehicle and boat driving. Re-afforestation schemes are also proposed for overcoming the fuel shortage, experiments having shown that eucalyptus trees can be successfully grown in Brazil so as to yield wood at the end of five years at a cost of about 3*s*. per cubic metre.

IN papers read before the American Society for Testing Materials recently, Dr. Henry M. Howe and Mr. A. D. Little discussed some aspects of the organisation of industrial research. Dr. Howe divided the four phases of research into selection, planning, execution, and interpretation. In order that all these conditions may be satisfied, there should be a wider appreciation of the exact functions that a research should fulfil and greater co-operation amongst the scientific and technical men and bodies concerned. For the selection of a research, prophecy and breadth of view are essential; planning requires imagination and administration; execution, skill and trustworthiness; and interpretation, a philosophical mind. After enumerating the aims of research organisation, Mr. Little admitted that industry must look to the higher institutions of learning for the determination of funda-

mental facts and constants, the development of theory, and the establishment of general principles. Research must be given greater prominence at such institutions to enable industry to recruit the proper type of worker for its own research problems. It is desirable to provide technical schools with more experimental plant on an *industrial* scale, so that students from the schools will be able at once to apply their research methods to the requirements of the industrial firm which they enter. In conclusion, Mr. Little emphasised the importance of creating an interest in research problems in the mind of the manufacturer and the public.

PIUTTI, in 1886, pointed out that while *d*-asparagine is sweet, its stereo-isomer, *l*-asparagine, is tasteless. This was the first observation indicating the nature of the connection which may exist between the flavour and the molecular structure or configuration of an organic compound. Since that time a large number of records have been made as to the effect which changes in chemical composition or molecular arrangement bring about in the flavour of organic substances. Thus *d*-leucine and *d*-phenylalanine have been found to be sweetish, whilst their *laevo*-isomers are bitter; and of the anisaldoximes the one with the *anti*-configuration is very sweet, whereas the *syn*-aldoxime is tasteless. The monohydric alcohols are only slightly sweetish, but with increase of the number of hydroxyl groups, as in the glycols, glycerols, etc., the sweetness becomes very marked. On the other hand, the strong sweet taste of "saccharin" is destroyed by relatively slight molecular transformations, such as the replacement of an imide hydrogen atom by a methyl or ethyl group. In the *Revue Scientifique* for December 7, 1918, MM. Barral and Ranc give an interesting summary, ten pages in length, describing the present state of knowledge respecting what may be called the chemistry of sweet flavours. In fine, the known facts, they consider, resolve themselves into a series of approximations to generalisations, but there are always exceptions or anomalies. We are, indeed, still very far from being able to establish a general law, such as would enable the flavour of a compound to be deduced when its molecular structure is known.

CRUDE α-trinitrotoluene, the high explosive, is liable to contain small quantities of its β- and γ-isomers. The three substances are very similar in physical properties, and are equally powerful as explosives. Although the α-variety is by no means a sensitive explosive, some accidents have occurred with it which have not been satisfactorily explained, but which have indicated that the substance may sometimes contain a much more sensitive body. It has generally been supposed that the latter is derived from α-trinitrotoluene, but it may equally well be derived from the β- or the γ-isomer. Messrs. Ryan and O'Riordan (Proceedings of the Royal Irish Academy, December) give an account of an investigation which they have carried out in order to elucidate this question. In the course of their work they found that a sample of crude γ-trinitrotoluene contained a dark, amorphous substance which explodes on heating; this, they think, may be of considerable interest in connection with the explanation of the accidents mentioned.

DR. SIDNEY RUSS suggests a new X-ray unit in radiotherapy. The unit, termed a "rad," is based on the amount of radium which, when applied to malignant tumour cells, causes complete inhibition of their power to grow after an exposure for one hour; this is determined by tests on rat-cancer. For measuring the dose of X-rays administered to a patient, the photographic action of the rays is obtained on a photographic plate, and upon the same plate is impressed the photographic action of the standard radium. The plate is developed and a comparison made between the photographic impressions so obtained. For example, if the X-ray tint for an exposure of ten seconds equalled that obtained with an exposure of six seconds with the radium, the dose of X-rays during the ten seconds' exposure would be 1/600 rad (*Archives of Radiology and Electrotherapy*, No. 221, December, 1918, p. 226).

THE launch of the first large self-propelled seagoing reinforced-concrete vessel to be built in Great Britain—the *Armistice*—took place at the Ferro-Concrete Ship Construction Co.'s yard at Barrow-in-Furness on January 7, and forms the subject of an illustrated article in *Engineering* for January 10. The ship is of 205 ft. length between perpendiculars, 32 ft. moulded breadth, 19 ft. 6 in. moulded depth, and is to have a speed of about 7¾ knots with 400 indicated h.p. Trisec steel bars having a very high tensile strength were used for the reinforcement. The concrete was made up of a granite aggregate, sand, and British standard specification cement. The sand used was a mixture of coarse and fine grains, from ⅛ in. downwards; the aggregate consisted of granite chippings of assorted sizes, not less than ½ in. and not more than ¾ in. Fresh water was used exclusively for mixing up the concrete. The method used in construction was to build a box round the reinforcement bars, into which the concrete was poured and rammed hard. To reduce the quantity of timber employed a system of steel sheets, suitably stiffened, was used as shutters. The machinery consists of two cylindrical boilers 9 ft. 6 in. in diameter by 9 ft. long, to work at 140 lb. per sq. in. The engines are of the compound surface condensing type, having cylinders 15½ in. and 33 in. in diameter by 24 in. stroke.

IN the *Times* of January 14 there appears an interesting account of the surrendered German ships by a member of the Allied Naval Commission in German waters. The good German shooting is attributed more to superior range-finders and training than to the gunnery control system. The statement that the German ships unquestionably had more accurate range-finders than the British is not accepted by many of those in possession of the facts. It is generally agreed that the first German salvoes were excellent, but not necessarily better than the British, and that, whereas the British fire continued good, the German fire became erratic when the ships were hit. The primary function of a Service range-finder is to provide ranges when in action. It is essential that it should keep in adjustment under battle conditions. To save the reputation of the German range-finder it is necessary to attribute the failure to a peculiar human moral weakness, which, however, was certainly not in evidence throughout the war. As the result of the Battle of Jutland the superiority of British fire was recognised by the Germans, whose later conduct is some proof of this. The superiority of British range-finders was known to the German Government, which in 1914 approached British makers with regard to the supply of their instruments. During repeated competitive trials by the French Government the German range-finders were invariably beaten by the British. This defeat the Germans explained on political grounds, but as the result of extensive trials in Austria-Hungary British instruments were adopted throughout the Austro-Hungarian Navy and largely throughout the Army. These British range-finders which have defeated the German product in so many lands have optical parts made of British

glass. No German glass is used, and during the war a considerable amount of excellent optical glass has been made by the range-finder manufacturers themselves.

MR. JOHN MURRAY'S new list of announcements contains the following forthcoming books:—"Travels in Egypt and Mesopotamia in Search of Antiquities, 1886–1913," Dr. E. A. Wallis Budge, 2 vols., illustrated, in which is given the story of the author's missions to Egypt, the Great Oasis, and Mesopotamia, the results of his excavations at Acevân and Nineveh and Dêr in Babylonia, and particulars of the excavations in Assyria and Babylonia from 1782 to 1913; a new and revised edition of "Heredity," Prof. J. Arthur Thomson, illustrated; "The Adventure of Life," Major R. W. McKenna, R.A.M.C., dealing with the question of the origin of life, and showing that, in the development of higher forms and the "survival of the fittest," intelligence, and not brute strength, has been the dominating factor; and "Hints to Farm Pupils," by E. Walford Lloyd, the aim of which is to put in concise terms the most important features of farming which a pupil must master. The volume will contain a seasonal "Calendar of Farm Work."

OUR ASTRONOMICAL COLUMN.

THE COMET 1786 II.—This comet is of interest as being the first of the eight comets discovered by Miss Caroline Herschel. It was observed for eighty-two days, being visible to the naked eye for a fortnight. The observers were Maskelyne (Greenwich), Wollaston (Chislehurst), Méchain and Messier (Paris), and Reggio and Cesaris (Milan). Miss Margaret Palmer, who has made a re-investigation of the orbit (*Astr. Journ.*, No. 744), finds the following ellipse as the most probable orbit:—

$$\left.\begin{aligned} T &= 1786\ \text{July}\ 7{\cdot}91859\ \text{Berlin M.T.} \\ \omega &= 324^\circ\ 57'\ 59{\cdot}23'' \\ \Omega &= 194^\circ\ 27'\ 11{\cdot}37'' \\ i &= 50^\circ\ 55'\ 5{\cdot}97'' \end{aligned}\right\} 1786{\cdot}0$$

$$\log q = 9{\cdot}6128774$$
$$\log e = 9{\cdot}9995992$$
$$\text{Period} = 9373\ \text{years.}$$

The observations are fairly satisfied by orbits ranging from an ellipse with period 3300 years to a parabola. Perturbations by Mercury, Venus, the earth, and Jupiter have been applied.

PARALLAX OF THE BARNARD STAR.—*Astr. Nach.* (No. 4971) contains a determination of the parallax of this star, made by photography at Pulkova by Dr. S. Kostinsky. He finds $0{\cdot}622'' \pm 0{\cdot}022''$, a larger value than those found in America, which group themselves about $0{\cdot}53''$. He gives for the proper motion in R.A. $-0{\cdot}0438$s., in decl. $+10{\cdot}249''$. Place at epoch 1917·473 17h. 53m. 46·456s., $+4^\circ\ 27'\ 57{\cdot}28''$ (equinox of 1917·0). Photographic magnitude, 10·6; photo-visual (with yellow filter), 9·4.

THE BRITISH SCIENCE GUILD AND ITS EXHIBITIONS.

AT a dinner given at Princes' Restaurant on January 15 several speeches were made concerning the results of the British Scientific Products Exhibition held by the British Science Guild in August and September last, and also the work of the guild for the advancement of science and its application to industry.

The Marquess of Crewe, president of the exhibition committee, was in the chair. After the usual loyal toasts he proposed "The British Science Guild," alluding to the valuable educational work which it had conducted since its foundation in 1905. The war had brought home to everyone the value of scientific method and knowledge, not only as a weapon in war, but also in industry and education. In these respects our adversary Germany had truly eaten of the tree of knowledge, but that fruit had turned to poison because of the spirit in which it was eaten. Our task must be to dissociate science from this disastrous spirit, to show that the proper applications of science, pursued with reverence and humanity, added immensely to the happiness of mankind. The guild had pursued two main objects, which were, however, closely related. It desired, first, to secure fuller attention to science in the general education of youth. While a sound general education was necessary as a preliminary to technical specialisation, this general education should contain a fair proportion of scientific studies. The second object of the guild was to promote the higher branches of scientific research and to encourage their application to industry. As the Minister who brought into being the Department of Scientific and Industrial Research, he observed with pleasure the closer relations being established between science and industry and the growing recognition of the benefits of industrial research—results which were due, in a large measure, to the influence of the British Science Guild. The exhibition had proved a wonderful revelation of the possibilities of science. He hoped that it would be a permanent feature in the industrial life of the country, and that in future the guild would continue to flourish and play its part in the advancement of learning and science.

Lord Sydenham, who replied on behalf of the British Science Guild, referred to some of the difficulties encountered at the outbreak of war. For a long time we were dependent upon improvisation for articles urgently needed by the Army, Navy, and Air Service, and it was due to the efforts of British men of science that these needs had been met. Lord Sydenham proceeded to mention various instances of discoveries made in this country but afterwards developed abroad. Perkin's discoveries in relation to dyes furnished a well-known example. Helium gas was first discovered in the sun by Sir Norman Lockyer, and twenty-six years later was identified on the earth by the late Sir William Ramsay, these two distinguished men being the founders of the guild. The Americans are now producing it in large quantities as a non-inflammable gas for the inflation of airships. The British Science Guild aimed at the co-ordination of science, education, and industry. The British Scientific Products Exhibition had shown what British men of science could do. Another exhibition on a larger scale was planned for the present year. In the difficult reconstruction period science and scientific methods of direction in the Government could do a great deal to recreate national prosperity and provide happier and healthier conditions of life.

Mr. F. G. Kellaway, M.P., Parliamentary Secretary, Ministry of Munitions, in proposing "The Exhibitions of 1918 and 1919," said that events during the war had aptly illustrated the romance of applied science. Experience belied the idea that John Bull was a sluggish and lethargic person. It would be fitter to apply the description uttered by Milton two hundred and fifty years ago: "A nation that is not slow and dull, but a quick, ingenious, searching spirit, acute at invention." In proof of this he would mention two inventions relating to defence against hostile air-

craft. One of these was the simple and ingenious sound-ranging apparatus that had enabled searchlights to pick up, almost invariably, enemy machines over London. The secret of the other device was still locked up in the Ministry of Munitions, but the weapon was so powerful that hostile aircraft could not face it. Both these inventions were mainly due to men whose names were unknown to the general public. Mr. Kellaway also quoted facts to show how British manufacturers, aided by science, had met the sudden demands of the war. Sixty per cent. of the world's stores of mica, a material essential in the electrical industry, were located within the British Empire, yet before the war 50 per cent. was sent to Germany for treatment. Now things were very different. Similarly, we had formerly to go to Germany for magnetos and ignition plugs, yet to-day the British magnetos and plugs were the best in the world, and the output of these two articles had risen enormously during the war. It was the task of the British Scientific Products Exhibition to make such facts known and to encourage similar advances in the future.

This toast was responded to by Sir Robert Hadfield, who supplemented the remarks of the last speaker by referring to some of the achievements of the iron and steel industry. The biggest shell used in the war, 18 in. in diameter and weighing 1¾ tons, was produced in this country. It was capable of penetrating armour-plate 41 in. thick; at a range of ten miles it would still penetrate 22 in., and at twenty miles 12½ in. of armour-plate. We should not, however, follow Germany in using science as a weapon of aggression, but would, as the chairman said, apply it for peaceful ends in the spirit of reverence and humanity. Sir Robert proceeded to give some facts showing the success of the British Scientific Products Exhibition, which had attracted more than 30,000 visitors in London and 15,000 in Manchester—more than 45,000 in all. This year they hoped to make the exhibition much wider in scope. He wished to thank all who had contributed to the success of the exhibition in 1918, and referred especially to the services of the chairman of the organising committee, Prof. R. A. Gregory, and the secretary, Mr. F. S. Spiers.

The toast of "The Donors of the Exhibition Fund" was proposed by Mr. Charles F. Higham, M.P., who acted as honorary director of publicity to the exhibition. Mr. Higham explained that the cost of the exhibition had been defrayed from private enterprise, and it had not been assisted by the Government. He wished to express thanks to all those who had given their support, including the original donors (Sir William Mather, Sir Robert Hadfield, and Mr. Robert Mond) and the manufacturers who had responded to the invitation of the organising committee to contribute. Now that the exhibition had proved its worth he hoped many other manufacturers would participate on the next occasion, and that their contributions would be even more generous than in the past year.

Mr. Milne Watson, responding for the donors, emphasised the value of scientific methods of test in improving the quality of products, using as an illustration some experience in the ammonium sulphate industry. Manufacturers must be taught that the perpetuation of mediocre methods was wrong, and that it paid to use every available scientific weapon to secure the finest possible results.

In the absence of Mr. John Hodge, M.P., the toast of "The Chairman" was proposed by Prof. d'Arcy Thompson, the Marquess of Crewe briefly responding. This terminated the proceedings. The dinner was attended by about 150 men of science, manufacturers, and others associated with the exhibition.

EDUCATIONAL CONFERENCES.

THE seventh annual conference of Educational Associations, comprised of thirty-four educational societies, which was numerously attended, was opened at the University College, London, on January 1 and concluded on January 11. The inaugural address, characterised by abundant wit and humour, was delivered by Mr. Fisher, the President of the Board of Education. The conference week included also the annual meetings of the Headmasters' Conference, the Incorporated Association of Headmasters, the Association of Directors and Secretaries of Education, and the Association of Public School Science Masters, some of the proceedings of which have already been reported in NATURE.

At a joint conference of the educational associations held on January 3 an interesting address by Prof. John Adams, who is now in France, was read on "The Utility Motive in Education," in which he urged that pure knowledge often owed its opportunities to the help offered by practical applications, which he illustrated by reference to the strides made by physiology, the progress of which had hitherto been slow, so soon as it became associated with the teaching of students of medicine; to psychology, when education captured it, and it became included in the professional training of teachers; to navigation, which made possible the development of pure astronomy; and, lastly, to the technical demands of dyers and other practical people, which had led to such subsidising of chemistry teaching as had greatly favoured the disinterested study of the subject. Might we not find in all this, he said, some justification for the plea that a working arrangement could be made by means of which a clash might be prevented between the claims of the cultural and the utilitarian ideals? The demands of the practical man might be met, not only without forfeiting the right to carry on disinterested work, but also in a way to favour such work in its proper place. Man was one and indivisible; he must be trained to hold his own in both spheres, utilitarian and cultural. Knowledge that refined a man's character was as useful as knowledge that increased his productive power in a material sense. The swing of the pendulum was at present strongly in favour of the practical, and a hard fight might be necessary to get due attention to the other aspect. But they would certainly not succeed in maintaining a due proportion of the cultural elements if they set out on a crusade for the useless.

Miss Mercier, head of Whitelands College and president of the Training College Association, in delivering her presidential address to the latter, pleaded for a higher type of education for students training as teachers. The training college might, and should, become also a school of social service. Neither reading alone, nor desire of service alone, made the good teacher, but a blend of both. Students would often benefit by a university course, but some would not be suited to it. There should be large liberty in devising courses. Mr. George Lansbury, who spoke later to the same body upon teaching, urged that the teachers should cultivate a really radical outlook, by which he meant that outlook on life which went to the root of things. Unless there were a tremendous amount of idealism in the teachers, they would not make very much impression upon the children.

At the meeting of the Eugenics Education Society Prof. J. Arthur Thomson, of Aberdeen, gave an address on "The Eugenic Ideal of Education," which he defined as the organic improvement of the human breed, but one which, though primarily a biological ideal, had an horizon far wider than the poultry yard

or the breeder's pen. It recognised that it was dealing with a very complex organism, which was at least as much mind-body as body-mind; that the thinking, feeling, willing side of man's constitution was just as real as the throbbing muscle and thrilling nerve. It believed that character was as vital an organismal quality as stature, or weight, or length of life, or fecundity, and they must rid their minds for ever of the prejudice that the eugenic ideal smacked of the farmyard in any objectionable way. There was need for a wider and deeper recognition of the commonplace that young people are organisms—growing, developing, varying, too, if we would let them—serving what should be a joyous apprenticeship to the serious business of life. These children were not only little men and women in the making, but also young mammals—really and truly young mammals. Their health was not incidental—it was well-nigh everything; their motor system was not irrepressible without serious risks; their play was not a luxury, but an essential; their adolescence in the novel, artificial conditions of civilisation needed to be guided sympathetically; their adult functions and environment must be looked forward to and prepared for.

An address was delivered by Lord Gorell, Deputy Director of Staff Duties (Education), to the meeting of the Teachers' Guild on January 2 on "The Education of Men on Military Service," in which he related the steps that had been taken as opportunity served for providing means of instruction and education for men engaged in war service. Lord Gorell stated that there were at the present time at least three million students. The work had risen from below; it had not been in any way put upon the Army from above. The first aim was to give the soldiers some diversion from the stress of war; the second was the high ideal of education, to brighten intelligence and promote self-realisation; and the third was to help definitely in what they intended to do in the future.

Addresses were delivered to the members of the Teachers' Guild on "National and International Ideals on the Teaching of History" by Prof. F. J. C. Hearnshaw, of King's College, and by Miss A. E. Lovett, Vice-President of St. Hilda's Hall, Oxford. The former pleaded that the Spartan sought his ideal man of the type of Leonidas, the Athenian that of Pericles, the Roman that of Cæsar, the medieval schools that of Aquinas; but our present ideal is a communal one. We were seeking to evolve the excellent craftsman or the man of trained mind ready to take up work. Discipline and the sense of duty fitted men and women to play a right part in national life. They needed a knowledge of history which trained the imagination by the pageant of stories, then showed the relation of cause and effect. Later on two sides of a question were perceived, and so impartiality might be learnt. The mind's horizon widened by the study of great men and great careers. Miss Lovett urged in her address that the word "international" should connote added understanding and sympathy. The study of history affected action. Not only must truth be sought, but the question should also be constantly present: Are our ideals and aims for the aggrandisement of our country or for the world's good and the glory of God?

To the members of the Civic and Moral Education League an address on "The Physical and Psychological Bases of Education" was given by Dr. Eric Pritchard, in which he claimed that the same principles which led to good physical development applied to the making of good moral character. In describing at some length the nervous and cerebral mechanism of the formation of habit, he said that many disturbances, such as bad circulation, were, in fact, a kind of bad habit of the system. The first impression made on the tabula rasa of the virgin nerve-cell was of paramount importance. He had traced back chronic nervous coughs to over-stimulation of the respiratory apparatus at birth. The suggestive power of home environment often counteracted the work of the school. So bad was the influence of many homes in great industrial centres, and so strongly did he believe in the educational influence of the home, that he would almost be willing to see the homes of this country sacrificed for a generation if the bringing up of these expatriated children in orderly, disciplined institutions would provide a race of parents capable of making proper homes for the next generation. Dr. Constance Long, dealing with the same subject, said that character was the perpetual acquisition of something that was at all times incomplete, and its first requisite was that it should be capable of growth. National action was individual action multiplied a thousandfold, and to understand an individual it was necessary to study, not only his conscious, but also his unconscious mind. The psycho-analytic view forced us to realise that the unconscious side of the mind played a far larger part in our actions than was generally supposed.

Memorable addresses were delivered in various sections of the conference on art and its applications, on manual training and hand-work, on Nature-study, and on other subjects of deep interest to teachers. The various audiences had the advantage of inspecting a splendid exhibition of books, maps, wall-illustrations, and a variety of school apparatus. Such conferences at this critical time cannot fail to be of supreme value in widening the aims and strengthening the purposes of all engaged in the work of education.

At the annual meeting of the Association of Directors and Secretaries of Education, held in the County Hall, Westminster, on January 6, the newly appointed chairman, Mr. W. A. Brockington, Director of Education for Leicestershire, delivered an inspiring address in which he dwelt upon the vital significance of the Education Act of 1918, which he characterised as the realisation of a dream rather than as the development of a system—a phrase which would well describe the Acts of 1870 and 1902 with all their attendant statutes. The mind of the nation was open to receive new and enlarged ideas, and better educated than in 1870 and 1902; hence the Bill came into being at a happy moment. The administrative officers of education throughout the country welcomed the Act, since it realised in so large a measure the aims they sought, which were that the schemes of the local education authorities should embrace not only elementary, but also all other forms of education included in their jurisdiction, proportionate block grants, the control of laggard or recalcitrant authorities, the abolition of differential rating, the declaration of higher education as a duty, and the consequent removal of the rate limit in county areas; and, on the social side, the universal raising of the compulsory school age, the provision of adequate maintenance scholarships so that no capable child shall be debarred by poverty from the fullest educational facilities, the establishment of day continuation schools for those in employment between fourteen and eighteen, together with full freedom of organisation according to local conditions, the provision of full-time advanced schools of varied type, the restriction of child-labour, the adequate provision of physical training, medical inspection and treatment, and, lastly, the endowment of scientific and industrial research. It is a matter for much rejoicing that these aims have found expression under the guidance of a master-pilot in an Education Act. But the realisation of its provisions are beset with many and peculiar

difficulties which will require much patience, great courage, untiring effort, and a fine spirit of sacrifice on the part of the community to realise. Yet the reward will be great. There will need to be the closest co-operation among educational authorities to give the requirements of the Act their full effect, and they can only be solved painfully step by step. The supply of suitable teachers is in itself a vast problem, as well as the provision of appropriate buildings. The arrangement of the hours of instruction so as to meet the necessities of the various industries is scarcely less perplexing. In many cases it must be met by taking the whole of a working day or more per week for a limited period, and in rural areas during some weeks of the winter season. Indeed, it will be seen that no greater step was taken during the great war towards peace-time reconstruction, seeing that the Education Act, worked to its logical limit, means reconstruction all round.

THE PRODUCTION OF OIL FROM MINERAL SOURCES.[1]

MANY and very various products can be obtained by the carbonisation of bituminous minerals, the character and quality of the materials produced depending mainly upon the temperature at which the process is conducted. It does not, however, follow that all identical products will be obtained from different bituminous materials when they are subjected to the same temperature conditions, because the chemical composition varies, and consequently when subjected to heat the method of decomposition also varies. The organic body or bodies in shale are called kerogen, and this, on being subjected to moderate heat, yields oil of the olefine and paraffin series, ammonia also being produced. The organic matter in coals and cannels is generally described as volatile matter, and probably differs considerably in chemical character from the kerogen; consequently, on being subjected to moderate heat, different products are obtained, although they also are mainly of the olefine and paraffin series. When coals are subjected to high temperatures a different class of hydrocarbon is produced, mainly the hydrocarbons of the benzene series. It is probable that this would also be the case to a greater or less extent if shale were also subjected to high temperature in retorts similar to those employed for heating coal.

It is extremely difficult to obtain an even distribution of heat in any carbonisation process; consequently it is by no means easy to make certain of always obtaining the same products from a given material in the same proportions, and great care has to be exercised to ensure that the conditions are as nearly constant as possible. The form of the retort has much to do with the quantity and quality of the products obtained. In all cases the first effect of the heat is low-temperature distillation, because the material is introduced cold into the retort, and, however high the temperature of the retort, the heat must first get through the badly conducting mass before the temperatures can approximate to that of the retort, and by that time a considerable part of the volatile matter will have been driven off. Then another question arises, viz. whether the form of the retort is such that the volatile products, as they are formed, come in contact with the surface of the retort before being drawn off, or whether they are removed without being heated after they have been expelled from the material. The quality and character of the final products depend almost entirely upon this. Thus in horizontal gas retorts the volatile matter as it leaves the coal comes in contact with the highly heated arch and sides of the retort before it enters the ascension pipes and is carried to the hydraulic main. This causes radical changes in the volatile products, and hydrocarbons of the benzenoid or aromatic series are largely produced. On the other hand, in a vertical retort the volatile products, as they are released from the coal, ascend upwards through the cold incoming coal, only a portion coming in contact with the hot walls of the retort, and, as a consequence, the resulting products contain a considerable proportion of hydrocarbons of a paraffinoid nature.

Whether high or low temperature should be employed for carbonising bituminous material entirely depends upon what products are required. For gas-works, where a large-volume yield of gas is required, high temperature is essential, but where motor spirit, fuel oil, lubricating oil, and paraffin wax are required, low-temperature carbonisation must be adopted. In low-temperature carbonisation the gas produced is less than half that obtained by high-temperature carbonisation, and contains less hydrogen and more hydrocarbons than the latter; low-temperature carbonisation could, therefore, not be employed for the manufacture of gas for lighting purposes. The main distinctions between high and low temperature are as follows:—

High Temperature.	*Low Temperature.*
(*a*) Large volume of gas, say 12,000 cu. ft. on the average.	Low volume of gas, say 5000 cu. ft. on the average.
(*b*) Yield of sulphate of ammonia, on average, say, 20 lb.	Yield of sulphate of ammonia, on average, say, 10 lb.
(*c*) Yield of tar on average, say, 11 gallons per ton of coal carbonised.	Yield of tar (crude oil) on average, say, 20 gallons per ton of coal carbonised.
(*d*) Tar is largely of aromatic series, and yields benzol, toluol, naphthalene, anthracene, carbolic acid, and cresols. These are the raw products for the manufacture of dyes, explosives, photographic chemicals, drugs, and many other synthetic products.	Tar (crude oil) consists of hydrocarbons of the aliphatic series (paraffins, olefines, and naphthenes). From the tar can be obtained motor spirit, fuel oil, lubricating oil, and paraffin wax. The tar acids are useful for disinfectants, but of no use as raw products for other industrial purposes.

It should be mentioned that when coals high in volatile elements and rich cannels are subjected to low-temperature distillation, much larger yields of crude oil are obtained, as much as 40 and 60 gallons.

Oils obtained by the carbonisation of bituminous material come under the same category as natural oils; they may, therefore, be classed as mineral oils, even although their origin was probably organic, as was that of natural oils, but many organic substances, such, for example, as peat or wood, will give oils of a similar character when carbonised under suitable conditions.

At the outbreak of the war the world's production of natural oil was in the neighbourhood of 50,000,000 tons, and last year more than 60,000,000 tons.

Before the war Great Britain was, with the exception of the oil obtained from the Scottish shale-oil industry (275,000 tons crude oil), entirely dependent upon imported oil for all the various purposes for which oil is required. Our aeroplanes, warships, motor-cars, etc., were dependent upon sea transport for petrol and fuel oil, and our machinery for lubricants. Unfortunately, we are still in the same position. Great Britain, with her vast Navy and her great

[1] Abstract of a paper read before the Institution of Petroleum Technologists on December 17, 1918, by Dr. F. Mollwo Perkin.

fleet of aeroplanes, is dependent for fuel upon sea-borne transport, and this should not be necessary, or, at any rate, only in a partial degree. In the future our merchant ships will probably burn oil fuel. We have at hand mineral resources from which we can produce mineral oils—petrol, fuel oil, lubricating oils, and paraffin wax. Why do we not employ them? There are, of course, many difficulties in founding a new industry, and one of the greatest difficulties has been Government action or inaction. There is now, however, a stirring among the "dry bones"; a great deal of experimental work has been carried out, much of it on semi-commercial plant, and there are now several large schemes under consideration, which would involve the putting up of an extensive plant both for retorting and refining the oil and to obtain power from the residuals or domestic fuel.

The ordinary shale retort is not adapted for dealing with caking bituminous material, or, indeed, for treating cannel and non-caking coals; hence the larger amount of research work which has been carried out in the endeavour to devise a suitable retort for dealing with bituminous materials which contain a large amount of fixed carbon, and will yield, after extraction of the volatile matter, a good fuel for domestic purposes. It might be replied: "But this is already obtained in the gasworks, where, when coal is carbonised to produce gas, a residue of from 68 to 70 per cent. remains in the form of coke, besides which tar and ammonia are produced." True, coke is produced, and this coke contains a very low percentage of volatile matter, and for this reason is not adapted for burning in the ordinary grate. Coke produced by low-temperature carbonisation (350°–550° C.) is softer than that produced at high temperatures (above 900° C.), and usually contains from 7 to 11 per cent. of volatile matter. The presence of this volatile matter causes the coke to burn readily, practically without flame or smoke, and to give out a great heat. It is, consequently, very clean for household purposes, and if it were used instead of coal the cost for the painting and decoration of the house would be considerably reduced. Furthermore, the atmospheres of our large towns and cities would be very much less contaminated by smoke, and the living conditions would be healthier.

In producing this smokeless fuel by low-temperature carbonisation there is produced at the same time oils of the aliphatic series, which on refining yield motor spirit, fuel oil for internal-combustion engines or for direct boiler firing, lubricating oils, and paraffin wax, besides which there is a small quantity of ammonia and sufficient gas to fire the retorts and leave a small surplus.

Now in low-temperature practice there are three possibilities, any of which might be a financial success, or they might be combined:—

(1) The production of oil and smokeless fuel.

(2) The production of oil and the conversion of the fuel residue into power-gas by gasifying it in a producer.

(3) The production of oil, using a portion of the fuel for domestic purposes and gassifying the remainder.

In districts where power is not required for manufacturing purposes, but where coal or cannel could readily be obtained without having to transport it for long distances, then the first proposition would be the one to embark on.

On the other hand, where cheap power in large bulk is required, then (2) would be the process to take up. Probably in all cases a certain proportion of the residue would be sold as smokeless fuel.

Those who do not know the quality of the low-temperature products have said: "We shall then be able to win back the dye industry from Germany." We nearly lost the war to Germany from lack of oil. Lord Curzon recently told us that at one time there was a stock of only 900,000 tons in the country against a minimum of 1,500,000 tons which the Admiralty considered necessary. The Fleet, in fact, had to restrict its exercises in order that, if a battle took place, there should be sufficient oil to go round. When we know more of the internal management of Germany during the war, it will doubtless be found that the Germans produced large quantities of oil by low-temperature carbonisation of bituminous material. They were doing so before the war.

One of the reasons why low-temperature carbonisation has, so to say, hung fire is due to the exaggerated claims made by inventors, backed up by company promoters. In all distillations of bituminous material water is obtained along with the oil, and is at times extremely difficult to separate, as the specific gravity of the crude oil approximates to that of water. In fact, it is not unusual to find 30 to 40 per cent. of water in the crude oil. This has all been lumped in as oil, hence the impossible claims for oil yields which have been made.

The days of exaggeration are, it is to be hoped, past, and careful research has taken the place of romance. If the claims are more moderate, at any rate we are working on a sure foundation, and many of us believe that a home oil industry can be founded on business lines, which, although not rendering us self-supporting, will, at any rate, supply a portion of our needs and tend to prevent exploitation.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—A new educational office has been established by the council of St. John's College, with a view to the co-ordination of the college teaching in natural science subjects and the special encouragement and direction of scientific research. Dr. W. H. R. Rivers, fellow of the college, has been appointed to this office, with the title of prælector in natural sciences. Mr. R. Whiddington, fellow of the college, has been appointed to the office of director of studies in physics.

The compulsory Greek in the Previous Examination was abolished by vote of the Senate on January 17. By a very large majority (161 to 15) the Senate approved a report of the Previous Examination Syndicate containing the recommendation that Greek should be made an optional subject. Although the final plans for the reconstitution of the examination are not complete, since the details of parts ii. and iii., which it is proposed shall consist of papers in mathematics, science, and English subjects, are still under consideration, the question of compulsory Greek was regarded as being so urgent that the proposals for part i. were submitted to the Senate without further delay. In consequence of the approval of this report, a candidate, after January 1, 1919, is allowed to take as an alternative to the old classical part i. of the Previous Examination a new part i., in which Latin is compulsory, but Greek is made alternative to French, German, Italian, or Spanish. The "additional subjects." which hitherto have had to be taken by candidates for an honours degree, are abolished.

Men who have been engaged on military service are now coming up to the University in large numbers, and lecture-rooms and laboratories have begun to resume something of their pre-war aspect. Four terms

are allowed to men who have been on war service for not less than six months, whether they have previously joined a college or not, and they are exempted either from the previous or from one special examination. Those who have served for shorter periods may also be granted certain exemptions.

At the end of January four hundred naval lieutenants and sub-lieutenants are coming to Cambridge for a six months' course. These are men who were promoted from the rank of midshipman during the war before completing their normal preliminary course of study. They will be distributed among several colleges, and will be under naval discipline. The University will provide instruction for them in physics and engineering, and, in addition, courses in various optional subjects, literary as well as scientific, are being arranged.

A COMMERCIAL library, established by the subscriptions of local business men, was opened in Dundee on January 17 by Sir Alfred Ewing, principal of the University of Edinburgh.

THE Edinburgh University Court has approved the scheme for the founding of a chair of mental diseases, submitted by the board of the Royal Edinburgh Asylum for the Insane, which has offered an endowment of 10,000*l.* towards the salary.

SIR JOHN HERKLESS, principal of St. Andrews University, announced that Mr. George Bonar, president of the Dundee Chamber of Commerce, has given 25,000*l.* to establish a scheme of commercial education in connection with University College, Dundee. One of the conditions of the gift is that a degree of Bachelor of Commerce should be established, and that university students seeking that degree should not be compelled to pass a preliminary examination or to have come from higher or secondary schools, but that boys or youths who present themselves should be admitted if they are able to show that they are capable of improvement and of undertaking university study.

SOME years ago Prof. MacGregor, of Edinburgh University, with the help of a committee of the late Prof. Tait's friends and former students, launched a scheme for establishing a Tait memorial chair in mathematical physics and applied mathematics. Considerable progress in collecting funds had been made, but Prof. MacGregor's death and the advent of the war prevented the scheme being proceeded with. Recently, however, the committee, with the cordial support of the University authorities, has resolved to make a general appeal for funds towards the endowment of the proposed chair. About 15,000*l.* will be required. In connection with this movement an anonymous donor has placed in the hands of the University Court for a certain number of years an investment yielding yearly a considerable interest to accumulate as part of the endowment of the Tait chair of mathematical physics. The Tait memorial committee will welcome similar contributions, which may be intimated to the general secretary of the Royal Society of Edinburgh, who acts as hon. secretary of the committee.

WE learn from *Science* that the will of Capt. J. R. De Lamar, mineowner and director, leaves nearly half of his estate, estimated at 4,000,000*l.*, to the Harvard University Medical School, Johns Hopkins University, and the College of Physicians and Surgeons of Columbia University for medical research. The bequests to these institutions in equal shares consist of his residuary estate, estimated at about 2,000,000*l.* He gave a trust fund of 2,000,000*l.* to his only child, Alice A. De Lamar, with the provision that if she dies without issue the principal of this fund also goes to the institutions named. The will requests that this fund be used "for the study and teaching of the origin of human disease and the prevention thereof; for the study and teaching of dietetics and of the effect of different food and diets on the human system, and how to conserve health by proper food and diet." The money is to be used to establish fellowships, scholarships, and professorships; to provide laboratories, clinics, dispensaries, and other places for study and research; and to publish the results of such research, not only in scientific journals, but also by popular publications and public lectures.

IT was pointed out by Sir J. J. Thomson in his presidential address to the Royal Society in 1917 that much public good might be done by the publication of a popular periodical in which all aspects of progressive knowledge are presented simply and accurately for general readers. Few articles of this type appear in the magazines; and the daily Press is naturally more concerned with subjects of topical interest than with descriptive accounts of the state of knowledge of any particular subject, however stimulating such surveys may be in style or substance. It is believed that teachers would welcome a periodical which would give them at least a glimpse of what is being accomplished in many developing fields of knowledge—scientific or otherwise—and that the extended views thus obtained would often put new life into the body of instruction. To consider proposals for the foundation of a periodical with this intention, a conference was held recently, with the Rev. Dr. Temple in the chair, in the rooms of the Royal Society, at which representatives were present of twenty associations, including the Conjoint Board of Scientific Societies, the Classical, English, Geographical, Public School Science Masters', Historical, Modern Language, Library, and Workers' Educational Associations, Royal Society of Literature, National Home Reading Union, and the chief professional associations of teachers. It was resolved by the conference that "it would be to the national interest if a journal could be established which would represent the growth of the chief branches of knowledge in popular form." An executive committee was appointed to draw up a scheme for the management of the journal, and therefore to secure whatever assistance is possible, by the selection of suitable contributors or guarantees of subscriptions, from the bodies represented at the conference. Should the scheme take practical shape, the proposed journal would stimulate public interest in learning of all kinds, and would thus be a valuable aid in changing the attitude of indifference commonly displayed towards intellectual endeavour in this country.

SOCIETIES AND ACADEMIES.

LONDON.

Mineralogical Society, January 14.—Mr. W. Barlow, past-president, in the chair.—A. **Hutchinson**: Stereoscopic lantern-slides of crystal pictures. The twin pictures are projected by means of a double lantern through screens of complementary tints—red and green—and are viewed through similarly tinted screens, one for each eye. If the adjustment is correct, a black-and-white picture stands out in relief. This method admits of the properties of crystals and of crystal-structure being demonstrated simultaneously to a large number of students.—L. J. **Spencer**: Mineralogical characters of turite (=turgite) and some other iron-ores from Nova Scotia. The mineral collection of the late Dr. H. S. Poole, which was presented to the British Museum in 1917, contains, amongst the iron-ores, specimens of magnetite, hæma-

tite, turite, goethite, limonite, chalybite, mesitite, and ankerite from many well-defined localities in Nova Scotia. The dehydration curves and optical characters of turite ($2Fe_2O_3,H_2O$), goethite (Fe_2O_3,H_2O), and limonite ($2Fe_2O_3,3H_2O$) prove that these, at least amongst the large group of ferric hydroxide minerals, are distinct species with crystalline structure; some others are colloidal. Turite (=turgite, an incorrect German transliteration from the Russian) is a hard, lustrous, black mineral, with a radially fibrous and concentric, shelly structure, and gives a dark cherry-red streak; the fibres are optically birefringent and strongly pleochroic. Sharp, brilliant crystals with the forms of goethite, but consisting of anhydrous ferric oxide, *i.e.* pseudomorphs of hæmatite after goethite, were described.

Royal Meteorological Society, January 15.—Sir Napier Shaw, president, in the chair.—Sir Napier **Shaw**: Presidential address: Meteorology—the society and its fellows. Sir Napier Shaw referred to the change in the position of meteorological work during the war from that of a subject of curiosity, which might safely be left to take its chance with such facilities as were left to the ordinary public by inexperienced censors and controllers, to that of a matter of such importance in gunnery and navigation of the sea and air that all reference to it was rigorously excluded from the newspapers, and a number of special services were improvised to meet the need for meteorological information for our own Forces, acting in co-operation with corresponding organisations for the French, American, and Italian Forces. To meet the demand for information about the fundamental principles and practice of the modern science, necessary for those who were called upon to take up technical duties with very limited training, the Meteorological Office had issued a number of books specially written for the purpose. Looking forward, he said that the immediate necessity was the organisation of the meteorological services to satisfy the demands of the home countries and meet possible requirements of the Dominions beyond the seas. The essential conditions of the organisation were, first, that there should be a career for men of ability, and, secondly, that there should be opportunity for suitable preparation by preliminary training in scientific studies, including meteorology, at the universities. At the same time efficient organisation of the public service required that the regular collection of information about the weather should be placed on a proper footing by arrangement between the central authority and local authorities. The duty which the society should discharge in the changed conditions was to foster or create an atmosphere which would make a satisfactory national organisation on those lines possible by the interchange of ideas and the discussion of meteorological subjects.

Mathematical Society, January 16.—Mr. J. E. Campbell, president, in the chair.—Prof. **Fréchet**: The differential of functional operations.—L. J. **Mordell**: The value of a definite integral.—Dr. T. J. I'A. **Bromwich**: Operational solutions in conduction of heat.

MANCHESTER.

Literary and Philosophical Society, December 10, 1918.—Mr. W. Thomson, president, in the chair.—Margaret W. **Fishenden**: The efficiency of domestic fires and the effects of certain "coal-saving" preparations. The experiments included determinations of (1) the "radiant efficiency," or the percentage of the total calorific value of the coal burned, which entered the room as radiation; (2) the distribution of radiation; (3) the volume of air passing through the room; (4) the amount of heat passing away above the ceiling level in the hot flue gases; and (5) the heating of the room air. Three different grates gave radiant efficiencies of 21, 24½, and 24 per cent. respectively; the radiant efficiency was not dependent upon the draught, even over such wide limits as from one to nine changes of air per hour. The maximum intensity of radiation was found (upwards) at an angle of about 60° to the horizontal through the centre of the fire. The amount of heat contained in the hot flue gases passing up the flue above the ceiling varied from about 55 per cent. of the total calorific value of the fuel burned for draughts of about 20,000 cubic ft. per hour (nine changes), to about 15 per cent. for one change per hour. The heat used in warming the room air was very small, generally below 10 per cent. Certain advertised preparations, solutions of which were claimed, when previously sprayed upon the coal, greatly to increase the efficiency of fires, had been analysed and found to consist chiefly of common salt. Their use was found to have no effect whatever upon the radiant efficiency, the duration of burning, or the rise of air temperature produced by coal-fires.

January 7.—Mr. W. Thomson, president, in the chair.—Sir E. **Rutherford**: The work and influence of Joule. Attention was confined to the first five years (1838–43) of Joule's scientific career, which began at the age of nineteen, and an endeavour was made to trace during this period the gradual growth of Joule's power of experimentation and of philosophic insight. This period was, in some respects, the most fruitful and inspiring in Joule's lifetime, for it included his remarkable researches on the transformations of energy in the voltaic cell, the dynamo and motor, and his first measurement of the mechanical equivalent of heat. A brief discussion was given of the reasons why the full recognition of the fundamental importance of Joule's earlier researches was so long delayed and of the difficulties experienced by Lord Kelvin in reconciling Joule's conclusions with the work of Carnot on "Heat Engines." Adjustment of views on both sides was necessary before the foundations of the new science of thermodynamics were securely laid, and before the great principle of the conservation of energy was generally recognised.

PARIS.

Academy of Sciences, December 30, 1918.—M. Léon Guignard in the chair.—**Albert, Prince of Monaco**: The course of the floating mines in the North Atlantic and the Arctic Ocean during and after the war. Experiments on the ocean currents have been carried out over a series of years, a large number of objects made of wood, metal, or glass, and constructed so that they float just below the surface out of the direct action of the wind, being used. The results have been accumulated during twenty years, and can obviously be applied to predict the course of floating mines. The probable track of these is shown on a chart, and the most dangerous localities are summarised as the Bay of Biscay, the west coast of Portugal, Morocco, the Canaries, and Madeira. From the Canaries to the Antilles the path of the mines is wider, and the return to Europe follows the course of the Gulf Stream.—A. **Lameere**: The Dicyemides.—M. **Balland**: The preserved fruit and jam distributed to the troops. An account of the adulterations found in these articles of food as supplied to the French Army.—Sir Almroth Wright was elected a correspondant for the section of medicine and surgery in succession to the late J. Bernstein.—E. **Vessiot**: An integral invariant of hydrodynamics and its application to the theory of general relativity.—L. **Lumière**: A method of record-

ing graphically by means of a jet of gas. It is proposed to replace the style by a very fine capillary. A stream of air carrying ammonia is led through the jet of this capillary tube and impinges on a moistened paper impregnated with mercurous acetate. The movements of the jet, which may replace the needle of a galvanometer, are recorded in black.—A. **Meyer**: Some derivatives of isatin.—P. **Gaubert**: The artificial coloration of liquid crystals. The use of indophenol as a colouring material presents great advantages over substances previously employed. By its means interesting results have been obtained relating to Babinet's rule and to the influence of double refraction on polychroism.—Ph. **Glangeaud**: The volcano of Sancy. Its secondary craters and its lavas.—P. **Lesage**: The utilisation of the curve of limits of germination of seeds after soaking in solutions. If seeds are immersed in alcohol there is a time beyond which the seed will not germinate, and this is a function of the strength of the alcohol. This relation between strength and time has been worked out for the seeds of *Lepidium sativum*. A possible application to the selective removal of the seeds of dodder is suggested.—L. **Lapicque**: The use of marine algæ for feeding horses. The experiments were carried out on *L. flexicaulis*, which were first dried, then washed freely with the addition of a little lime or acid for the removal of mucilage. The horse requires a certain time to get accustomed to the food, about a week, and then digests the algæ completely. For horses doing no work the seaweed can be used in place of oats; for light work, nutritive equilibrium was obtained with 1500 grams of algæ *plus* 500 grams of oats. A horse has eaten 140 kilograms of algæ in ninety-six days without visible inconvenience.—Mlle. Lucienne **Dehorne**: False incubation in *Heteronereis malgremi*.

BOOKS RECEIVED.

Dreams and Primitive Culture. By Dr. W. H. R. Rivers. Pp. 28. (London: Longmans and Co.) 1*s*.

War and Civilisation. By W. J. Perry. Pp. 27. (London: Longmans and Co.) 1*s*. 6*d*. net.

The Philosophy of Mr. B*rtr*nd R*ss*ll. With an Appendix of Leading Passages from Certain Other Works. Edited by P. E. B. Jourdain. Pp. 96. (London: G. Allen and Unwin, Ltd.) 3*s*. 6*d*. net.

The Origin and Evolution of Life. By Prof. H. F. Osborn. Pp. xxxi+322. (London: G. Bell and Sons, Ltd.) 25*s*. net.

A Manual of Elementary Zoology. By L. A. Borradaile. Second edition. Pp. xiv+616. (London: H. Frowde and Hodder and Stoughton.) 16*s*. net.

Forced Movements, Tropisms, and Animal Conduct. By Dr. J. Loeb. Pp. 209. (Philadelphia and London: J. B. Lippincott Co.) 10*s*. 6*d*. net.

Life and Finite Individuality. Two Symposia. Edited for the Aristotelian Society, with an Introduction, by Prof. H. Wildon Carr. Pp. 194. (London: Williams and Norgate.) 6*s*. net.

A Treatise on Gyrostatics and Rotational Motion: Theory and Applications. By Prof. A. Gray. Pp. xx+530. (London: Macmillan and Co., Ltd.) 42*s*. net.

A Manual of Geometrical Crystallography: Treating Solely of those Portions of the Subject Useful in the Identification of Minerals. By Prof. G. M. Butler. Pp. viii+155. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 7*s*. net.

A Treatise on the Sun's Radiation and Other Solar Phenomena, in Continuation of the Meteorological Treatise on Atmospheric Circulation and Radiation, 1915. By Prof. F. H. Bigelow. Pp. ix+385. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 23*s*. net.

DIARY OF SOCIETIES.

THURSDAY, JANUARY 23.

ROYAL INSTITUTION, at 3.—Prof. J. N. Collie: Chemical Studies of Oriental Porcelain.

ROYAL SOCIETY, at 4.30.—Admiral Sir H. Jackson and Prof. G. B. Bryan: Experiments Demonstrating an Electrical Effect in Vibrating Metals.—Prof. T. H. Havelock: Wave Resistance: Some Cases of Three-dimensional Fluid Motion.—W. S. Abell: Chances of Loss of Merchant Ships.—Prof. W. M. Hicks: A Critical Study of Spectral Series. Part V. The Spectra of the Monatomic Gases.

INSTITUTION OF ELECTRICAL ENGINEERS, at 6.—A. P. M. Fleming: Planning a Works Research Organisation.

FRIDAY, JANUARY 24.

ROYAL INSTITUTION, at 5.30.—Temp. Lt.-Col. A. Balfour: One Side of War.

INSTITUTION OF MECHANICAL ENGINEERS, at 6.—T. T. Heaton: Electric Welding.—Henry Cave: The Development of the Oxy-acetylene Welding and Cutting Industry in the United States.—J. H. Davies: Oxy-acetylene Welding.—F. Hazledine: Oxy-acetylene Welding.

MONDAY, JANUARY 27.

ROYAL GEOGRAPHICAL SOCIETY, at 8.—Commander Spicer Simson, D.S.O., R.N.: The Tanganyika Expedition. (*Duty permitting.*)

TUESDAY, JANUARY 28.

ROYAL INSTITUTION, at 3.—Prof. Spenser Wilkinson: Lessons of the War.

INSTITUTION OF CIVIL ENGINEERS, at 5.30.—Hon. R. C. Parsons: Centrifugal Pumps for Dealing with Liquids containing Solid, Fibrous, and Erosive Matters.

WEDNESDAY, JANUARY 29.

ROYAL SOCIETY OF ARTS, at 4.30.—Dr. F. Keeble: Food Production by Intensive Cultivation.

THURSDAY, JANUARY 30.

ROYAL INSTITUTION, at 3.—Prof. J. N. Collie: Chemical Studies of Oriental Porcelain.

ROYAL SOCIETY, at 4.30.—*Probable Papers:* Prof. J. C. McLennan and R. J. Lang: An Investigation of Extreme Ultra-violet Spectra with a Vacuum Grating Spectrograph.—Prof. J. C. McLennan and J. F. T. Young: The Absorption Spectra and the Ionisation Potentials of Calcium, Strontium, and Barium.—Prof. J. C. McLennan, D. S. Ainslie, and D. S. Fuller: Vacuum Arc Spectra of various Elements in the Extreme Ultra-violet.—R. C. Dearle: Emission and Absorption in the Infra-red Spectra of Mercury, Zinc, and Cadmium.—E. Wilson: The Measurement of Magnetic Susceptibilities of Low Order.—Dr. F. Horton and Ann C. Davies: An Experimental Determination of the Ionisation Potential for Electrons in Helium.

FRIDAY, JANUARY 31.

ROYAL INSTITUTION, at 5.30.—Prof. H. H. Turner: Giant Suns.

SATURDAY, FEBRUARY 1.

ROYAL INSTITUTION, at 3.—Prof. H. P. Allen: The Works of J. S. Bach.

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